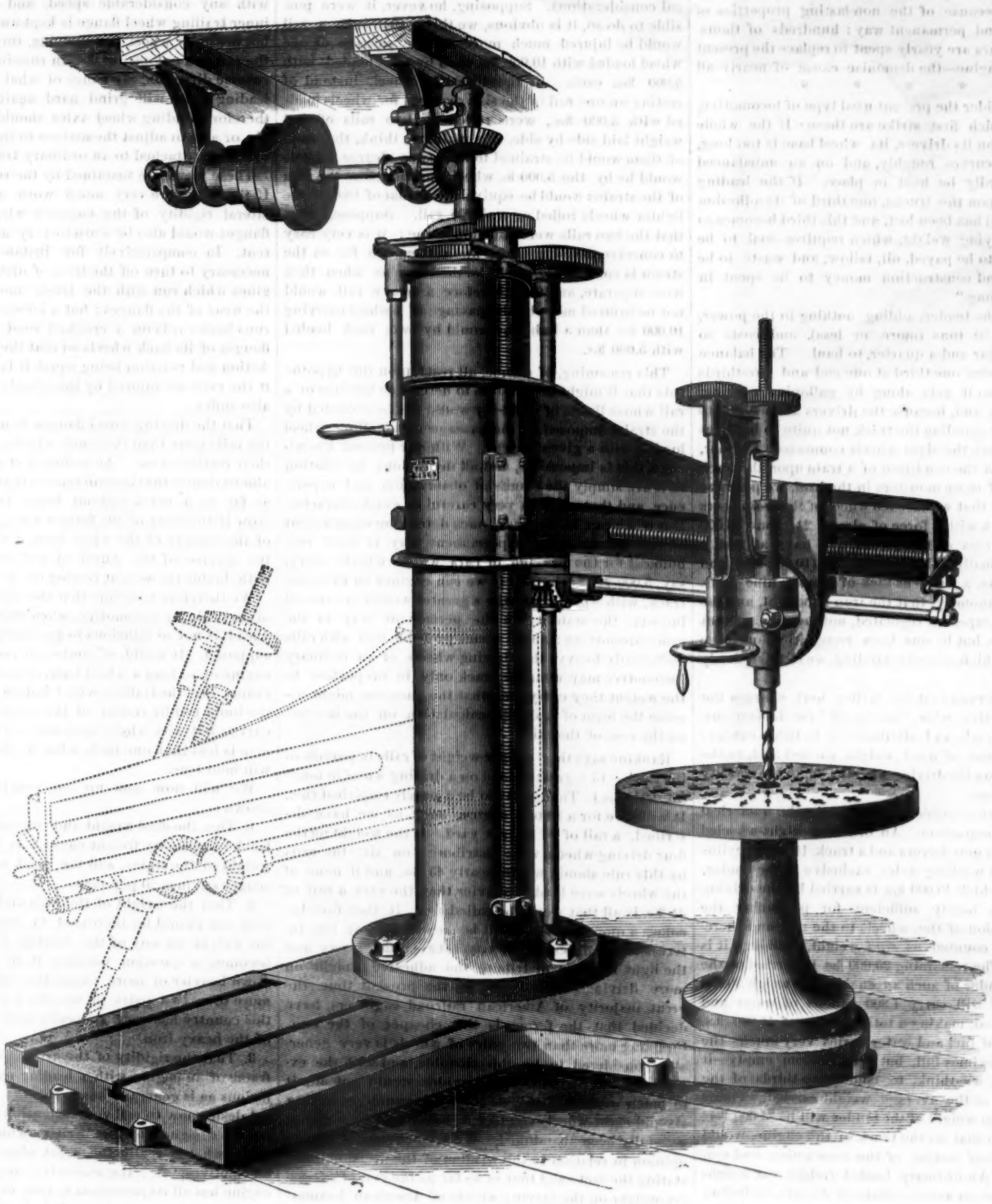
RAILROAD GAZETTE

SATURDAY, APRIL 8, 1871.

UNIVERSAL RADIAL DRILL.

We give herewith an engraving and description of Gray's Patent Universal Radial Drilling Machine, which the Niles Tool Works, of Cincinnati, is now manufacturing.

The whole machine swings around a stationary sleeve bearing well upon the interior of column. The column itself is turned all over, and the arm, which is fitted snugly to it, is raised or lowered by power. The driving is applied through the center directly (thus avoiding any interference from belts in the complete revolution of the machine), and transmited to an upright shaft, whence the horizontal shaft carries it to the spindle by means of two pairs of miter gears. The spindle is moved to any position on the arm by means of the horizontal screw. *The drill can be used vertically, horizontally, or at any required angle.* The combination of the swing of the entire machine, the raising and lowering of the arm, together with the complete swiveling capacity of the spindle, render it comparatively easy to drill any number of holes in any heavy or irregular piece of work without the necessity of moving it after it is brought within the swing of the machine.



Gray's Patent Universal Radial Drilling Machine.

It is a well-known fact that in drilling a cumbrous or unwieldy piece of work more time is required to set it in position than to do the drilling. The tool represented in the accompanying engraving, it is claimed, saves the great expense of leveling and adjusting, beyond placing the work within a circle about eleven feet diameter. This done, a hole can be drilled at any conceivable point, at any height and at any angle.

The advantages arising from the employment of such a machine in drilling cylinders, engine frames, and an endless variety of work of this class, are evident. Although recently invented, it is rapidly getting into use, and is strongly recommended by those who have tried it. It was awarded the first premium medal at the International Industrial Exhibition in 1869, and the gold medal at the Cincinnati Industrial Exposition in 1870.

Contributions.

SIMPLE RULES FOR LOCOMOTIVE ENGINEERS AND MACHINISTS.

[Continued from Page 1.]

The rules given last week for obtaining the gravity of one ton, on any grade, were as follows:

RULE No. 1.—To find the gravity, in pounds, for tons of 2,240 lbs.: Multiply the height of the grade in feet per mile by the number .4242; point off four places for decimals, and the product is the required gravity in pounds.

RULE No. 2.—For tons of 2,000 lbs.: Proceed by the above rule, using only the number .3787 in place of .4242.

To know, then, what load a given engine will take, up a given grade, we must have the power of the engine.

The most ready method of obtaining the power of the engine, approximately, is to regard it as one-sixth of the weight of the engine, weighed upon its driving wheels. If an engine weigh, at the driving wheels, 15 tons, or 30,000 lbs., it is safe to consider its power as 5,000 lbs.

I have before explained how the power of the engine can be determined from the dimensions of its cylinders, wheels and the pressure of steam; but as this power is generally equal to the friction, or "adhesion" of the drivers, the latter element forms the simplest and readiest expression of power. In calling the adhesion one-sixth the weight weighed at the drivers, a correct understanding must be had of what this adhesive power is.

If an engine have 15 tons weight on its drivers, and 5,000 lbs. adhesion, its power might be tested as follows:

A weight of 5,000 lbs. could be suspended over a pulley at the end of a rope and allowed to hang freely in a deep pit or shaft. If the engine were attached to the end of the horizontal part of this rope, and steam were applied, one of the three following results would occur:

1. If the steam power were less than the adhesion, the wheels would not be moved and the load would not be raised.

2. If the steam were just equal to the adhesion, the load would be raised as fast as the engine could supply itself with steam of the same pressure as at starting.

3. If the steam power was greater than the adhesion, before the inertia of the weight was overcome the driving wheels would begin slipping upon the rails.

In either case, the power of the engine is limited either by its adhesion or steam power, both of which, therefore, should be as nearly equal as possible, as any excess of one over the other is so much wasted.

Adding together, therefore, the resistance of friction, in pounds per ton, and the resistance of gravity on any grade, also in pounds per ton, and dividing the whole power of the engine by the sum, the result is the number of tons which may be drawn by the assumed engine on the assumed grade. The resistance of gravity is about the only one which can be mathematically obtained and exactly stated in dealing with railroad trains. All other resistances vary with speed, condition of cars, track, winds, weather, etc. It is impossible, therefore, to give any general rule which will be exact in all cases for determining the ordinary resistance to trains in motion. At speeds of 10 or 12 miles an hour, which are slow freight-train speeds, the ordinary resistances on a level, with ordinary cars, may be said to be 8 lbs. per ton—seldom less and often more. In calculating the resistances of freight trains, generally, at the speeds of under 15 or 16 miles an hour, 11 lbs. per ton is a safer number to be used. The following is, therefore, the rule for obtaining the draft of a freight engine, at slow speed, on levels or grades.

FOR LEVELS.—Divide one-sixth of the weight on the driver, in pounds, by 11; the quotient is the number of tons of cars and load drawn at speeds of about 16 miles an hour.

FOR GRADES.—Divide one-sixth of the weight as before, by the sum of 11; and the gravity in pounds per

ton on the given grade; the quotient is the tons which will be taken over the grades at speeds of about 15 miles an hour. The gravity will be found by the rules at the head of this article.

LOCOMOTIVE REFORM.

[Read by N. M. Forney, before the New York Society of Practical Engineering, at their last meeting.]

The March number of *Van Nostrand's Engineering Magazine* contains an article on this subject written by Mr. Louis Nickerson, C. E., in which he says: "While "track is being torn into ribbons, so as to be often dan- "gerous, stockholders are grumbling at non-payment of "dividends, directors are regretting their inability to "pay them, and superintendents truthfully excusing "themselves because of the non-lasting properties of "iron rails and permanent way; hundreds of thous- "ands of dollars are yearly spent to replace the present "ponderous engine—the demoniac cause of nearly all "damage." * * * *

"If we consider the present-used type of locomotive, "the faults which first strike are these: If the whole "weight is upon its drivers, its wheel-base is too long, "it traverses curves roughly, and on an unbalanced "road can hardly be held in place. If the leading "wheels are upon the trucks, one-third of its adhesion "(more or less) has been lost, and this third becomes so "much non-paying weight, which requires coal to be "burned, men to be payed, oil, tallow, and waste to be "purchased, and construction money to be spent in "pushing it along."

"Behind is the tender, adding nothing to the power, "but weighs 20 tons (more or less), and costs so "much, say a car and a quarter, to haul. The balance "is unequal, being one-third at one end and two-thirds "at the other, so it gets along by galloping, rocking, "and plunging, and, because the drivers are set stiff to "the frame, by grinding the track not quite so badly as "its brother with the eight wheels connected. Further, "if we consider the condition of a train upon the track "with either of these monsters in the lead, we perceive "this anomaly, that whilst each wheel of the train bears "upon the track with a force of almost 2½ tons (5,000 "lbs.), the drivers of the locomotive have at rest a "weight of, usually, about five tons (10,000 lbs.), and "when plunging, a frequent kick of almost nine tons. "There is the anomaly, that the iron is bought, and the "maintenance expenses regulated, not by the amount "of work done, but by one keen recognition of these "very faults, which, notwithstanding, we cling so firmly "to."

It will be observed that the writer here charges the present locomotive with "nearly all" the damage sustained by the track, and attributes it to three causes: 1st, to the amount of dead weight carried; 2d, to the excessive load on the driving wheels; 3d, to the rigidity of the wheel base.

The first is susceptible of a very simple numerical estimate and comparison. An ordinary eight-wheeled locomotive with four drivers and a truck, 16x24 in. cylinders, weighs, in working order, exclusive of the tender, 60,000 lbs., of which 40,000 lbs. is carried by the driving wheels and is barely sufficient for producing the requisite adhesion of the wheels to the rail, and therefore cannot be counted as *dead* weight, although it is non-paying. The remaining 20,000 lbs. is carried on the truck. The tender of such an engine will weigh 20,000 lbs. empty, and will carry 1,800 gallons of water and three tons of coal, making a total weight of 41,000 lbs. As the supply of fuel and water varies very much—the tank being sometimes full, but very seldom empty—it would be fair, we think, to count two-thirds of the water and coal as the average weight carried. Therefore, the average weight of the tender will be 34,000 lbs., which, added to that on the truck of the engine, would make the *total dead* weight of the locomotive and tender 54,000 lbs. An ordinary loaded freight car weighs 40,000 lbs. so that an average train of 25 cars, including the weight of the engine and tender, will weigh 1,094,000 lbs., and consequently the dead weight of the locomotive will be a little less than 5 per cent. of the total weight of the train, and therefore that proportion of the wear to the track is due to the superfluous—if the word is admissable in this connection—dead-weight of the locomotive and tender. With passenger trains the proportion is still greater. For comparison, I will take the weight which has just been given me by the superintendent of a leading Western railroad:

Locomotive and tender	94,000 lbs.
Mail car	33,000 "
Baggage	36,000 "
1 coach	36,000 "
1 coach	33,000 "
70 passengers	9,800 "
Mails	2,000 "
Baggage and express	10,000 "
Making a total of	257,800 lbs.

So that the *dead weight* of the engine and tender is more than 20 per cent. of the total weight of passenger trains, and that proportion of the wear and tear which the track sustains from passenger traffic must be attributed to the dead, or, perhaps more accurately, the non-adhesive, weight of the locomotive and tender.

The injury sustained by the track, and which is attributable to the second cause—the excessive load on the driving wheels—is not so easily estimated as the first. That a rail might bear the strain due to a load of 5,000 lbs. per wheel without material deterioration and yet be permanently injured by a weight of 10,000 lbs. per wheel, would not be difficult to show; but the precise weight of rail which would be just heavy enough to bear 5,000 lbs. without immediate deterioration it would be hard to determine by purely theoretical considerations. Supposing, however, it were possible to do so, it is obvious, we think, that such a rail would be injured much more by the passage of one wheel loaded with 10,000 lbs. than by two loaded with 5,000 lbs. each. If the 10,000-lb. wheel, instead of resting on one rail of the size required for wheels loaded with 5,000 lbs., were rolled on two rails of that weight laid side by side, it is plain, we think, that each of them would be strained to the same degree as one would be by the 5,000-lb. wheel, and therefore the sum of the strains would be equivalent to that of two of the lighter wheels rolled on a single rail. Suppose, now, that the two rails were rolled into one; it is very easy to conceive that the effect upon them—so far as the strain is concerned—might be the same as when they were separate, and that therefore a heavy rail would not be injured more by the passage of a wheel carrying 10,000 lbs. than a light one would by two, each loaded with 5,000 lbs.

This reasoning, of course, all rests upon the hypothesis that it might be possible to determine the size of a rail whose limits of elasticity would not be exceeded by the strains imposed by the passage of a rolling wheel loaded with a given weight. With our present knowledge, this is impossible, and all deductions in relation to it are simply the results of observation and experience, and that not of a very careful or exact character. But if we can, in any way, once determine what weight of rail and character of permanent way is most economical for the passage of cars whose wheels carry, say, 5,000 lbs. each, then if we run engines on the same track, with wheels carrying a greater weight, we should increase the stability of the permanent way in the same proportion; and it seems probable that with rails sufficiently heavy, the driving-wheels of an ordinary locomotive may wear the track only in proportion to the weight they carry, and that the question might assume the form of a simple calculation on the interest on the cost of the rails.

Rankine says the "proper weight of rails in pounds to the yard = 15 × greatest load on a driving-wheel in tons" (of 2,240 lbs.) This seems to be a purely empirical rule. It will give for a 30-ton engine, such as we have described, a rail of 67 lbs. per yard. If the weight on the four driving-wheels were distributed on six, the rails by this rule should weigh nearly 45 lbs., and if none of the wheels were loaded heavier than the cars, a rail of 34 lbs. is all that would be called for. It therefore becomes a question whether it is cheaper to pay the interest on the difference of cost between the heavy and the light iron, or distribute the adhesive weight on more driving-wheels. Up to the present time the great majority of American railroad engineers have decided that the former is the cheaper of the two. Coupling more than two pairs of wheels is very generally considered to be objectionable, and with the exception of those roads whose grades would not admit of being worked in any other way, locomotives having six and eight wheels connected have, in this country, generally been abandoned. We are not expressing any opinion in relation to the wisdom of the decision, only stating the fact; and that in so far as the evil of excessive weight on the driving-wheels of American locomotives is concerned, our practice has decided that it is less than that incurred by connecting more than two pairs of driving-wheels, and that the latter is a greater evil than the increased cost of permanent way.

With regard to the third charge which our writer has brought against the locomotives of the present type, viz., the rigidity of the wheel-base, we are disposed to believe that very much misconception, exists in relation to it and its effects upon the track. At any rate it is only on a curved track that the lateral rigidity of the axles is injurious to the rails. On a straight track, flexibility, or "articulation," as the French term it, of the running gear is not necessary, because the flanges of the wheels will not impinge against a rail so long as their planes are parallel to it. If, however, they stand at an angle to the rail—as they necessarily must on rolling around a curve—unless the position of the axles is continually changed, the flanges will be rolled *against* the rail in moving in one direction, and away from it in moving the other way. In the one case the rail would be abraded by the flange; in the other the flange would not touch the rail. The question then arises, whether the flanges of the wheels whose axles are rigid in the frame, roll against or from the rail. A little reflection or examination will show that the flanges of the wheels which are back of the center of the wheel base (measured from the center of truck to center of trailing wheel) roll *from* the rail when the locomotive runs forward on any ordinary curve, and, therefore, they do not impinge against it. The flange of the trailing wheel on the outside of the curve is kept against the rail by the centrifugal force of the engine, if it runs with any considerable speed, and consequently the inner trailing wheel flange is kept away from the rail, but the outer wheel, in revolving, turns its flange *from* the rail and not *against* it. In running an engine the reverse direction, the flange of what would then be the leading wheel will grind hard against the rail, and, therefore, leading wheel axles should always be flexible, or able to adjust themselves to the curve, as they can when attached to an ordinary truck.

These views are sustained by the results of practice. If the rails were very much worn on account of the lateral rigidity of the engine's wheel-base, then the flanges would also be worn to very nearly the same extent. In comparatively few instances, however, is it necessary to turn off the tires of driving wheels of engines which run with the truck ahead on account of the wear of the flanges; but a locomotive which often runs backwards on a crooked road will soon cut the flanges of its back wheels so that they must be turned. Action and reaction being equal, it is fair to infer that if the rails are injured by the wheels, the latter would also suffer.

That the driving-wheel flanges do not impinge against the rails more than the truck wheels, is also shown by their relative wear. An ordinary steel tire, which has almost double the circumference will run just about twice as far as a truck without being turned or replaced. Now if the wear of the former was greater on account of the rigidity of the wheel base, it would not do twice the service of the wheel of half the size, especially with double the weight resting on it.

We therefore conclude that the rigidity of the axles of an ordinary locomotive, when running with a truck ahead, is not so injurious to the track as is ordinarily supposed. It would, of course, be possible to make an engine of so long a wheel base, or a curve of so short a radius, that the trailing-wheel flanges would run against the inner rail by reason of the great convexity of the curve; but with wheel bases and curves whose versed sine is less than one inch, what we have said we think will hold true.

We will now sum up our conclusions. We have shown:

1. That the *dead* weight and consequent wear to the track of ordinary freight engines is 5 per cent. of the weight of the trains, and the dead weight of the passenger engines 20 per cent.

2. That the weight of the rails and their consequent first cost should be increased in direct proportion to the weight on any of the driving wheels, and that it becomes a question whether it be advisable to put down heavier or more expensive rails, or to connect more than two pairs of wheels, a question which in this country has very generally been decided in favor of the heavy iron.

3. That the rigidity of the driving-wheel axles in the frame of an engine with a leading truck is not so injurious as is generally supposed.

I desire now to call your attention to a plan of locomotive designed by the writer, which, he thinks, obviates what is really the great objection to ordinary locomotives, viz: the excessive dead weight.* This engine has all its *permanent* weight, excepting the tanks, on the driving wheels, and it is thus available for creating adhesion. The water and fuel are carried on the truck, and as it is desirable that the locomotive should be guided by wheels which will adjust themselves to curves, the truck is run ahead, thus reversing the usual motion of the engine.

An engine of the size represented, with about two-thirds of a full supply of coal and water, will weigh 64,000 lbs., of which 44,000 lbs. will be on the driving wheels and 20,000 lbs. on the truck, or dead. In other words, the dead weight of such an engine will be less than 2 per cent. of the weight of freight trains, and less than 9 per cent. of passenger trains, instead of 5 and 20 per cent., as was shown in the proportion with ordinary American locomotives. This, of course, makes it possi-

*This locomotive was illustrated in THE RAILROAD GAZETTE of November 12, 1870.

ble to haul just that much more paying freight. It will be observed that the engine has a truck to guide it, and has a long wheel base for steadiness. If it were thought desirable to distribute the weight on more than four driving wheels, more could be added, and all be connected; but, as we stated before, there are objections to coupling more than two pair of wheels.

One of these locomotives was built for the Chicago, Burlington & Quincy Railroad nearly three years ago, and has been running ever since. It has been doing good service, the chief objection to it being that the arrangement for carrying coal was somewhat inconvenient, an objection which has been remedied in the present plan. Mr. Wells, the Master Mechanic of the Jeffersonville, Madison & Indianapolis Railroad, has also built three small engines on this plan, and a late number of the London *Engineer* had a lithograph showing substantially the same thing, designed by Mr. Kirtley, and built for the Metropolitan traffic of the Midland Railroad.

Locomotives of this design are considerably simpler than ordinary engines, have only eight instead of sixteen wheels, and fewer parts otherwise. They weigh from twelve to fifteen tons less, and the cost is reduced in somewhat the same proportion. The chief objection which is urged by railroad men against their introduction is, that they—the railroad men—"do not try experiments," an objection which would lead one to believe that an experiment was a crime, and indicates a policy which, should it become fixed and universal, may in time develop a civilization which will rival that of the "Heathen Chinee."

RELATIONS OF TRAINS TO CURVES.

BY SAMUEL J. WALLACE.

[Continued from page 578.]

Railways consist of two parts, the track and the train; one stationary, the other rapidly moving. Between these two parts a peculiar medium of connection is required.

THE WHEEL SYSTEM.

This is provided for by wheels. These wheels have in their nature certain capacities of functions and certain laws by which the capacities arise and which direct and limit their action. In this use they are involved forcibly in certain functions, as being the points of action of all the great forces of the train. And besides all these conditions imposed upon the use of wheels by their own nature, and by their subjection to the forces of the train, which two may be termed the fundamental conditions, there are certain important incidental conditions which are imposed by the nature of the structural arrangements that may be adopted to form the wheel system. All of these conditions are within our means of study, and some are tolerably well known.

We know the general nature of a wheel. It can apply force in two ways, direct and indirect: 1st, in any direction in a plane of direct action, which is at right angles to the axis of revolution; 2d, in either of the two directions in the line of the axis, by indirect action, when there is a sufficient step bearing provided either on the end of the axle or by a shoulder bearing. And we know that a wheel, by its nature as a wheel, must decompose all forces which it receives into two virtual kinds of strains in the line with, and at right angles to, its axis, which it will receive or communicate each by its proper journal bearing at virtual right angles to its line of direction. Each of these kinds of strain can be served if the bearings for it are sufficient and suitable, and all parts of the wheel are suitable. As used in the train the direct action has its plane of direction vertical and near the line of the track, and is served by the tread of the wheel. In this the device acts to advantage. The indirect action is applied to the side of the rail and is served by the flange. It acts to a disadvantage from rubbing and slip on the rail, which cost motive power and are aggravated by curves.

We also know of the great strains in the train and their usualties and directions, and that their maxima are rendered extravagant by oscillations, boundings, and rockings in running, and by shocks of contact between the cars, and that thus the forcible conditions of action are a very serious matter for consideration.

But it is the incidental conditions of use which are of most interest to us. It is here the terms of condition depend exactly on our own choice of device, and that engineering thus gives ground for ambition to reach the highest available perfection. The present conditions of usage will prove to be very serious terms in causing regular wear and tear, and the ghost of destruction which flies beside every moving train.

The power with which the several terms of condition act depend partly on the perfection of the structures in the train and the track, but nearly altogether on the amount of curvature of the track.

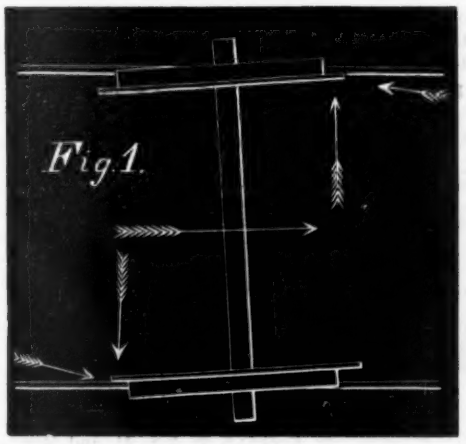
CONDITIONS INCIDENT TO PRESENT USAGES.

The present system of train stock uses as a unit a wheel for each rail of track fixed immovably on one axle which turns in bearings at each side of the car. There are two ways in which these units are used: 1st, connected to the car frame, in use in Europe; 2nd, to a truck frame, having some margin between the particular motions of the wheel frame and the car, in use in America, but not for driving wheels of locomotives.

In each, two units are set in a frame together, being either the car frame of a truck, or "bogie." And in each there is a certain portion peculiar to the condition of each style.

The relations of the styles are—where the wheels are attached directly to the car frame, the cars are limited to the size that will run on four wheels, and the weight of the car may be reduced by the omission of truck-frames. Where truck-frames are used, the size of the cars may be as large as eight wheels will bear; the wheels of each fixed truck may be nearer together and permit the axles to be more nearly radial on curves; the wheel frame has more range of conformability to the track, and is more free from the motions of a heavy car, but has less power of guidance and more tendency to erratic action—including the peculiar actions the structure used involves. If the peculiar action caused by the structures in use could be rendered easy on curves, the truck system would be suitable for large cars and the other style for light stock.

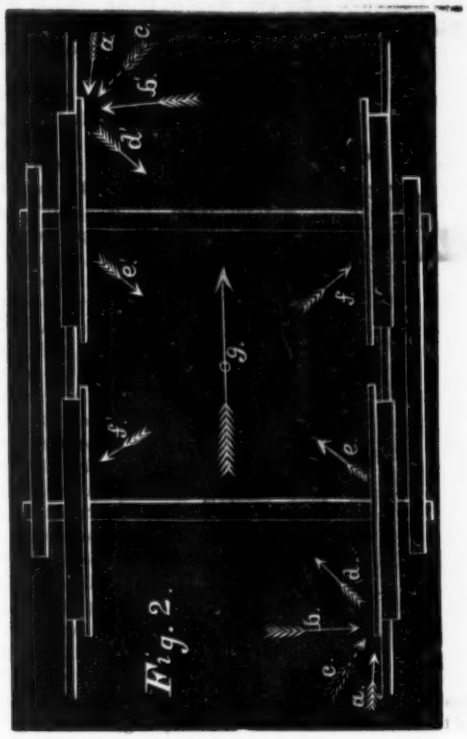
If a single pair of such wheels were run on the truck free of outside strains, a peculiar condition of action would occur. Then running on a straight track both would turn freely and directly in the line of track and with little loss of motive power. On a curve with one rail longest, the wheel on the outside would not by equal turning keep up with that on the inside rail. Then if the axle was by any means forced to remain nearly radial to the curve, one or both wheels must slip the distance required to equalize the two sides. This is equal to dragging the whole load so far with fixed wheels. The wheel having the lightest load or least hold on the rail will slip most. The slipping will be in proportion to the amount of curve and the width of the rails apart, and its strain is determinable. The strains of the wheels thus in opposite directions will tend to turn the wheels on the axle, or to twist the axle, or "wring its neck." This requires an axle suitable to withstand great torsion strains. The further tendency and lines of strain are indicated in fig. 1. The flange



of the outside wheel rubs the side of the rail in front; and that of the inside wheel rubs the inner rail in rear. This brings a strain tending to break off the flanges, to bend the wheel sideways, or to bend the axle, and this strain is repeated as the wheels turn, so as to strain the parts in all directions, rapidly following, so that a danger exists of finding and increasing any weak spot to which all the force would concentrate. This requires careful provision for endurance in all the parts.

When two pairs of wheels are set in a wheel-frame, the whole has a peculiar action similar to that above stated. The actions and lines of direction of strain are shown in fig. 2. The force of the action is double that of a single pair. The strain tends to revolve the frame on its center. The foremost flange crowds the outer rail, and the rearmost flange crowds the inner rail. If the wheels are near together, the forcible effect is greater, and it acts to wedge the rails apart on the curve in proportion to the sharpness of curve and the force of the train. It requires both rails on the curve to be fixed more stable and firm than is needed on straight lines. The action is not counteracted by the great strains of the train which throw against one or the other rail on the curve, but acts by addition of force to the rail to which they are directed, and by reaction on the other.

When the wheels are set on the car-frame, the front end of the car crowds the outer rail, and the rear of the car the inner rail; but the greater distance of the



wheels apart and the strain of draft through the train has great force to guide and govern the action; and the result is more influenced by the side-directed forces. And when a car has two pivoted wheel-frames as trucks, the crowding of the rails apart takes place separately in each truck, and the forces through the train have little guidance or control.

This difference of action between the two styles, one much used in England and the other in America, deserves notice to prevent too wide generalization, (as instanced by one of Mr. Fairlie on this subject some weeks ago in the Railroad Gazette.) The actions are essential to the devices as now employed on all curves. They add to the forces there acting to cause the front flange to climb and run over the outside rail. They help to keep the rear end of the trailing car to the inner rail instead of flying over the outside rail (mainly in the English style). And they help to run the front end of the train off the track.

Further consideration is deferred now, lest railway men get disgusted with having curves, and railway officers fear to see silent lines of ghosts sitting along every curved embankment waiting; and competing lines count the cost of motive power used, wear and tear of structures, and time lost in running; as well as increased weight of cars required by the curves, in deciding capacity to pay on small margins.

Keokuk, Iowa.

—Governor Hoffman gives as his reasons for vetoing the bill for the New York Pneumatic Tube Underground Railway, that, taking the opinion of E. H. Tracy, civil engineer, the buildings along the side which the tunnel is to be made would be seriously damaged and endangered; that the tunnelling on Fourth avenue could not be done without impeding the surface travel; that the sewerage, especially that at Canal street, would be seriously interfered with and disturbed, and that the company, although incorporated for some time, had not yet complied with the requirements of their charter. In conclusion, the Governor says he is extremely anxious to have some mode of quick transit provided for New York, and if this was the one to afford it, he would be glad to sign the bill.

—The Peoria Board of Trade have passed the following complimentary resolution on the occasion of the departure from their city of Mr. S. W. Corwin, Agent of the Indianapolis, Bloomington & Western Railway: "That we hear with regret that Mr. S. W. Corwin, Agent of the Indianapolis, Bloomington & Western Railway Company, is about to leave Peoria, and we desire to express our appreciation of his unusual ability as a railroad agent, and high worth as a business man and gentleman, manifested in the time of his residence here."

—The Housatonic Railroad has bought the Ames Iron Works at Fall Village, Mass., and will use these buildings for car manufacturing and repairing.

Buffer-Headed Draw-Bar.

The draw-bar shown by the accompanying engraving will be seen to differ very slightly, in its general plan, from those most commonly used. The inventor, an employe of the Lake Shore & Michigan Southern Railway, has simply added to the draw-head, used on that company's passenger cars, two enlargements or shoulders, to serve as stops to limit the forward and backward movement of the draw-bar. When the train is started suddenly the rear shoulder, *G*, in fig. 2, limits the amount of compression of the spring by abutting on the plate at the rear of the sill, *D*. This position of the draw-bar is shown in fig. 1. This stop serves further, in the event of the failure of the spring, to prevent the withdrawal of the bar. The office of the shoulder, *H*, is readily seen. When the cars collide the pressure is first sustained by the spring, and the force of the blow gradually reduced, until the further receding of the bar is stopped by the shoulder striking the buffer plate at the front of the sill, *D*.

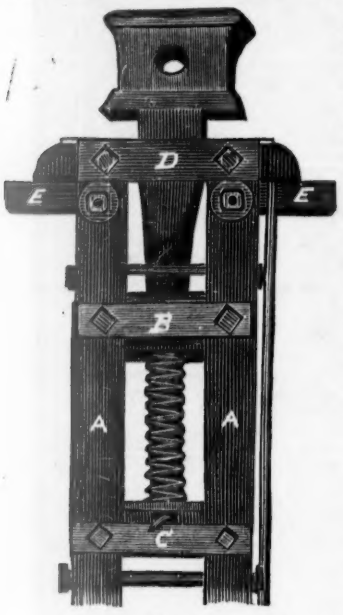


Fig. 1.

Fig. 2.

The arrangement for applying the spring is strong, simple and compact. A pair of disks or washers are placed loosely on the draw-bar, at each end of the spring, the rear disk abutting on the sill, *C*, and being prevented from sliding off the bar by a pin, while the forward disk abuts on the shoulder of the draw-bar, and also on the sill, *B*.

This invention was patented in 1869, and since then has been generally adopted on the Michigan Southern road and made use of to a considerable extent by a number of other companies. Mr. David S. Beals, the inventor, is at Adrian, Michigan.

Fig. 3.

RAILROAD LAW.

***Speed of a Train at Road Crossings**—Jury must determine it—Contributory negligence not imputed to a frightened foot-passenger.*

In the case of the *Delaware, Lackawanna & Western Railroad Company vs. Smith*, the Supreme Court of Pennsylvania have decided that:

1. There is no rule of law that fixes what is a reasonable rate of speed on a railroad in crossing a road; it is a question for the jury.

2. It is not proof of contributory negligence, that a foot-passenger, frightened by the near approach of the train, ran the wrong way.

One John Smith was killed by being struck by a locomotive, at a place where a public road crosses the railroad at grade. His widow and heirs bring suit. The railroad company asked the Court to instruct the jury that if they believed that the bell was rung on the locomotive as it approached, and the rate of speed did not exceed fifteen miles per hour, the defendants could not be held to have been negligent and the plaintiffs could not recover.

The Court refused, and instructed the jury that if they found the facts as stated, and that the rate of fifteen miles was not, under the circumstances, an unreasonable speed, the plaintiffs could not recover. It certainly could not be assumed a matter of law that fifteen miles an hour was a reasonable rate of speed. No rule prescribes the rate of speed on a railroad compatible with the safety of the public.

The railroad company also requested the Court, practically, to instruct the jury that travelers on foot, crossing a railroad on a public road at grade, can never recover damages of the railroad company. To which the Supreme Court, Sharswood, J., reply:

"A man finding a train rushing upon him at a frightful rate, at so short a distance, cannot be expected to retain his presence of mind, nor will the involuntary mistake of running the wrong way, under such circumstances, be imputed to him as negligence *per se*. The learned judge was asked to lay down a proposition in the abstract, without reference to the circumstances of the case, which was entirely too broad, and which was therefore properly declined."

Validity of Mortgage Binding Subsequently Acquired Property.

In the recent case of *Pierce vs. the Milwaukee & St. Paul Railway Company*, it has been decided that the mortgage made by the company to one Lowry, in 1856, of a certain portion of their road covers subsequently acquired property. By the terms of the mortgage all the rolling stock and real and personal property then belonging to the road, or to which in future it might have a right, were mortgaged to Lowry. And in the mortgage, the company, among other things, covenanted "to execute and deliver any further reasonable and "necessary conveyance or conveyances of the premises, "or any part thereof, to the said party of the second "part," "for more fully carrying into effect" the trusts created, "particularly for the conveyance of any rights, "interest or property subsequently to the date hereof "acquired by the said parties of the first part, and "comprehended, or intended so to be, in the descrip-"tion or terms of this instrument."

The plaintiff in this suit, in June, 1868, sold and conveyed to the Milwaukee & Horicon Railroad Company the premises mentioned in the pleadings, and upon which a vendor's lien for the purchase money is sought to be enforced. The Court holds that the vendor's lien would not lie.

***Evidence.**—Negligence in loss by fire, who shall prove?—When a contract of a barrier contains an exception of loss from fire, and the loss falls within it, the burden of proof of negligence is on the plaintiff.*

In the case of *Patterson vs. Clyde et al.*, the Supreme Court of Pennsylvania has decided the following proposition. The authorities upon which it is based are collated in the following note:

LAW NOTE.—*Harris vs. Parkwood*, 3 Taunton, 264; *Marsh vs. Horne.*, 5 Barn. & Cress., 322; *Muddle vs. Stride*, 9 Carr & Payne, 380; *Clark & Co. vs. Spence*, 10 Watts, 635; *Goldey vs. Pennsylvania Railroad Co.*, 6 Casey, 246; *New Steam Navigation Co. vs. Merchants' Bank*, 6 Howard, 384; *Farnham vs. Camden & Amboy Railroad Co.*, 5 P. F. Smith, 59, 60. CONTRA. — *Humphreys vs. Reed*, 6 Wh., 435; *Whitesides vs. Russell*, 8 W. & S., 44, and *Hays vs. Kennedy*, 5 Wright, 378.

***Liability of Railroads for Injury to Stock.**—The Fence Law.*

The statutes of Missouri makes it the duty of railroad companies to "erect and maintain good and sub-"stantial fences on the sides of their roads where the "same pass through, along, or adjoining inclosed or "cultivated fields, *or uninclosed prairie lands*; * * * "and also to construct and maintain cattle guards" at specified points. It is then provided that until these considerations are complied with, railroad "corpora-"tions shall be liable in double the amount of all dam-"ages which shall be done by their agents, engines or "cart to horses, cattle, mules or other animals on said "roads, * * * *occasioned* by the failure to construct "or maintain such fences or cattle guards."

In order to the recovery of double damages under this statute three things, at least, would seem to be indispensably necessary, namely:

1. Failure on the part of the railroad corporation to provide the required fencing and cattle guards at the points designated. 2. An injury inflicted by its agents, engines or cars; and, 3. That the injury complained of should have been *occasioned* by the absence of the fence or cattle guards.

The case of *Cecil vs. Pacific Railroad Company* is brought under this law to recover double damages for the loss of a horse. The lower Court told the jury, in effect, that if they found from the evidence that the plaintiff's animal was injured uoon the defendant's railroad by the engine or cars of the company at a point where there was no fencing, they would find for the plaintiff, and assess his damages according to the rule declared in the instructions.

The Supreme Court find this to be a grevious error and say:

"The instruction thus left out of view the questions as to the character of the *locus in quo*, whether "uninclosed prairie land" or not; whether the animal got upon the road at that point or whether it strayed upon the road at any point where the defendants were bound to fence, or whether it come upon the road at any point in consequence of the absence of either fence or cattle guards. Under this instruction the jury might have found for the plaintiff, although the animal may have strayed upon the line of the road at a point where the defendants were not bound either to fence or erect cattle guards, and although the injury may have occurred at a place where the defendants were not required to fence or erect cattle guards. The statute gives double damages only where the absence of the fence or cattle guard is the occasion of the injury, and at a point where the railroad company is bound to fence or erect cattle guards."

Tax of Dividends and Interest Paid by Corporations.

The following decision by Alfred Pleasonton, Commissioner of Internal Revenue, is given in a recent letter to Supervisor Dutcher, of New York. The corporations enumerated in the sections referred to are banks, trust companies, saving institutions doing a general banking business, insurance companies, railroad, canal, canal navigation and slack-water companies:

OFFICE OF INTERNAL REVENUE,
WASHINGTON, February 27, 1871.

SIR:—Upon further consideration, it is deemed advisable to publish in the *Internal Revenue Record*, the following instructions, which, it is believed, cover all the questions which have arisen respecting the liability to tax of dividends, surplus profits and interest on bonds of the corporations enumerated in sections 120 and 122, act June 30, 1864, as amended, and section 15, act July 14, 1870.

First—Dividends of the corporations enumerated in sections 120 and 122 aforesaid, which were *declared* at any time prior to August 1, 1870, are subject to a tax of five per cent.

Second—Undivided profits of said corparations which are carried to the account of any surplus or contingent fund, prior to August 1, 1870, are subject to a like tax of five per cent.

Third—Interest (or coupons representing interest) due from the corporations mentioned in section 122, which became *due and payable* prior to August 1, 1870, is also subject to tax of five per cent. Returns of these dividends and surplus profits should be made on Form 65, and returns of this interest on Form 68.

Fourth—All dividends of the corporations brfore mentioned which were declared within the last five months of 1870 are exempted from a *dividend* tax, even when said dividends are composed wholly or in part of profits accrued prior to August 1, 1870.

Fifth—Profits carried to the account of a *fund* within the last five months of 1870 are exempt from a surplus tax, even if said profits were earned prior to August 1, 1870.

Sixth—No tax should be withheld from interest (or coupons representing interest) falling due and payable within the above period of five months.

Seventh—Dividends of said corporations which are *declared* on or after January 1, 1871, are taxable as follows: If composed wholly of profits accured or earned prior to August 1, 1870, at the rate of 2½ per cent.; if composed partly of profits accrued prior to August 1, partly of those accrued within the last five months of 1870, and partly of those accrued since January 1, 1871, at the rate of 2½ per cent. upon so much of the dividend as represents profits accrued either prior to August 1, or subsequent to December 31, 1870, excluding profits of the last five months of 1870.

Eight—Profits carried to the account of a *fund* on or after January 1, 1871, are subject to the same liability to tax as the dividends above described. So much of such profits as were earned prior to August 1, or subsequent to December 31, 1870, are taxable at the rate of 2½ per cent.

Ninth—Profits of the corporations previously mentioned, which were earned or accrued within the last five months of 1870, are not taxable when divided or carried to the account of a *fund* subsequent to December 31, 1870.

Tenth—Interest falling due and payable on or subsequent to January 1, 1871, is taxable at the rate of 2½ per cent. if such interest accrued either prior to August 1, or subsequent to December 31, 1870. From so much of it as accrued within the last five months of 1870 no tax whatever is to be withheld.

Eleventh—Returns of dividends and surplus profits by the corporations mentioned in section 15, act of July 14, 1870, should be rendered on Form 65 1-2, and returns of interest on Form 68 as revised.

Twelfth—All previous rulings of this office, inconsistent with these instructions are herewith revoked.

A. PLEASONTON, Commissioner.

MECHANICS AND ENGINEERING.

Niles Tool Works.

The company are about transferring their works from Cincinnati to Hamilton, Ohio. The new buildings have a floor area of 47,158 square feet, 40,690 of which are located on the ground floor. The buildings and dimensions are:

Office building, two-stories	44x 65
Pattern " " "	44x 82
Foundry and cleaning room	46x117
Core oven	20x 32
Engine-house	22x 65
Machine shop	65x332
Blacksmith shop	44x 80
Stables, stock-room and sheds	20x100

Cost of a Six-feet Gauge Railroad.

In the recent report of the Ohio & Mississippi Railroad Company, the following detailed account of the Louisville Branch is given. This branch extends from North Vernon southwest to Jeffersonville, and is 53 miles long. Near its southern terminus the country is hilly and the cost of grading was large:

Rights of way, legal expenses, etc	$43,739
Expenses of engineer corps	21,285
Real estate and depots	77,071
Engine-houses, shops water stations, etc	25,373
Earthwork on contracts and by company	713,589
Masonry for bridges and culverts	174,556
Ties for road track	94,466
Wood purchased	5,151
Iron bridges built	57,076
Iron rails for track	472,881
Spikes, bolts, splice-bars, etc., for laying track	137,104
Total	$1,822,292

This is at the rate of $34,383 per mile without equipment, which is nearly double the cost of some of our prairie railroads.

Express Engines.

A correspondent of the *English Mechanic* contributes to that paper the following description of the central rail engines for running over Mont Cenis:

"On this line, which is 47¾ miles long, with an average gradient, for 24 miles 7 furlongs, of 1 in 60; 6 miles 4 furlongs, of 1 in 15; 4 miles 1¼ furlongs, of 1 in 33; 12 miles 1¼ furlongs, of 1 in 14½; and for short distances of 1 in 12 in some parts. On this railway there are two rails, as on other lines, but between them, and raised up 9 in., there is a central rail placed sideways. Against the two sides of this rail, four horizontal wheels run, which can be made to grip it with any required pressure from the footplate of the engine. There are also four perpendicular wheels running on the other rails. The cylinders (two in number) are 15 in. diameter and 16 in. stroke, and they work at the same time on the two systems of wheels, which are both four wheels coupled. The four perpendicular wheels are 2 ft. 3 in. diameter, with flanges on them. The four horizontal wheels, are the same size, but without flanges. The gauge of the line is 3 ft. 7½ in., distance between centers of perpendicular wheels, 6 ft. 10 in., and between centers of horizontal wheels 2 ft. 4 in.; weight of engine, in working order, 17 tons 2 cwt.; number of tubes 158, of 1½ in. diameter; heating surface, 600 square feet; working pressure, 120 lbs. per square inch. This engine can take a load of 48 tons up a gradient of 1 in 12, at about eight miles per hour. The maximum pressure that can be put on each of the horizontal wheels is 6 tons, or 24 tons altogether on the central rail."

Demand for Steel Rails.

Herapath's Railway Journal (London) says:

"We hear that every steel rail manufactory in the country is now full with orders for the next two years, and that the price of the best Bessemer steel is some £12 per ton.

"The difficulty now appears to be not to pay for steel rails but to get them. This great demand for them arises from the marked economy in their use. Considerable savings are being made by our railway companies in the maintenance charges, due to steel rails. Thus experience has already supported theory as to the great advantage of steel rails."

LOCOMOTIVE STATISTICS.

Burlington & Missouri River.

Mr. George Chalender, Master Mechanic of the company, makes the following report for the month of February, 1871:

Miles run by passenger trains	36,681
" " freight "	49,000
" " miscellaneous "	17,015
Total number of miles run	102,696

The average cost per mile was:

For repairs	5.61 cts.
For oil, waste and tallow	0.79 "
For fuel	8.82 "
Total cost per mile run	15.22 cts.
For engineers, firemen and wipers	7.80 "

The average number of miles run was:

To one ton of coal	39.03
" pint of oil	15.60

Coal is charged at $3.50 per ton. Forty-nine locomotives made mileage during the month, five were in shop all the month, two were in shop most of the month, one was in shop part of the month, and one entered service on the 15th.

Illinois Central.

The report of S. J. Hayes, Superintendent of Machinery of the Illinois Central Railroad, for the month of January, 1871, affords the following:

Passenger trains	120,955
Freight	298,799
Construction, etc	2,877
Switching	60,490
Total	483,121

The cost per mile run was:

Oil, and waste	0.64 cts.
Fuel	7.16 "
Cleaning	1.04 "
Repairs	8.21 "
Total cost per mile run	17.05 cts.
Engineers, firemen and wipers	5.97 "

Cost per mile run, in cents:

Passenger engines	18.21 cts.
Freight engines	24.83 "
Construction engines	15.55 "
Switching engines	16.46 "

Average number of miles run to

Pint of oil	14.04
Ton of coal	33.14

One hundred and seventy-eight locomotives made mileage during the month. This report is for 974 miles operated. Four locomotive has had general or thorough repairs, and twelve are undergoing repairs.

Chicago, Rock Island & Pacific.

The following is the report furnished from the General Superintendent's office for the month of February, 1871:

ILLINOIS DIVISION, INCLUDING PEORIA BRANCH.

The number of miles run by trains was:

Passenger trains	37,289
Freight "	80,005
Miscellaneous "	6,995
Total	124,289

The average cost per mile run was for:

Fuel	6.78 cts.
Oil and waste	0.63 "
Repairs	6.75 "
Total	13.46 cts.
Engineers, firemen and wipers	7.21 "

Number of miles run to

Pint of oil	17.55
Ton of coal	43.91

IOWA DIVISIONS, INCLUDING CHICAGO & SOUTHWESTERN RAILWAY.

The number of miles run by trains was:

Passenger trains	38,981
Freight "	72,887
Miscellaneous "	21,032
Total	132,900

The average cost per mile run was for:

Fuel	6.37 cts.
Oil and waste	0.67 "
Repairs	6.73 "
Total	13.77 cts.
Engineers, firemen and wipers	7.42 cts.

Average number of miles run to

Pint of oil	16.29
Ton of coal	41.68

The whole number of locomotives owned by the company is 145, of which 75 are on the Iowa divisions and 70 on the Illinois divisions; seven of these made no mileage. Four locomotives have been in the Chicago shops during the month, and, part of the month, one in the Rock Island shops, two in the Davenport shops, and two engaged in Chicago & Southwestern Railway construction.

Railroading in the Olden Times.

William Hambright, an old conductor on the Pennsylvania Central road, who, we are told, is familiarly known throughout the State as "Cap," "Cappie," "Pap," or "Conductor Hambright," has given to the Columbia (Pa.) *Courant* some account of his experience.

Mr. Hambright commenced his career as conductor by taking the first train (horse cars) out of Lancaster, in 1833, after which time he run regularly, and has been employed nearly all the time since as passenger conductor on the Pennsylvania Central Railroad. He then acted as conductor, brakeman and greaser; his compensation being eighteen dollars per month, which was considered good wages at that time. His train of horse cars would leave Lancaster at five o'clock p. m., and arrived in Philadelphia at five o'clock the next morning, making twelve hours for the journey; and the fare changed was $3.50. Stoppages were frequent, fresh horses being employed every fifteen or twenty miles. At times they would be greatly detained by the severity of the weather, the winters in those times being much colder than at the present day.

There was no fire in the cars, and when a stop was made to change horses the conductor would make for the nearest hay-stack or barn for the purpose of procuring straw or hay to strew upon the floors of the cars, in order to make his passengers more comfortable, himself riding outside, the cars generally being packed so full that he could scarcely gain admission. Down grade the horses were always kept at a full run. Horse flesh was very cheap then—sometimes five good animals could be purchased for $100. In the year 1835 a locomotive, built by Norris, was brought from Philadelphia to Lancaster, in wagons (why it was not brought by rail we did not learn); however, the wonderful machine was put upon the track and fired up in presence of an immense assemblage of spectators. It appears the enterprise was not very successful, as it would run a short distance and then halt; then a number of muscular men would lend their assistance by pushing. Every device was resorted to to make the critter go, but to no purpose. Some time after this three small engines were purchased in England and sent over, which answered all the purposes for which they were intended, one of which is in use at the present time in York, Pa., sawing wood.

The Harrisburgh & Portsmouth Railroad, as it was then called, being laid upon strong pieces of wood, using flat bar iron fastened down with spikes, it was necessary to carry hammer and spikes on the engine. Very often spikes would come out from the end of the bar, causing the end of the same to stick up, which were termed "snake-heads," and the engineer would be obliged to stop and spike down before attempting to pass over. Information had to be given to the engineer, before starting, where stops were to be made.

Here we may state that to Mr. Hambright belongs the credit of inventing the bell and rope system for signalling engineers. He got permission from his "boss" to put his idea of the thing into practicable shape. Procuring a rope and common door-bell, he attached the latter near the engineer, no house being over the locomotive at that time, then stretched the rope over the tops of the cars. Ever after that and up to the present time bell-ropes have been in vogue, though in a more approved style than the one just described.

Conductors were not required to make reports at the end of each trip, as now practiced; they would hand over the gold and silver—perhaps two or three hundred dollars or more—to the clerk, who would enter it in a book provided for the purpose somewhat in this wise: "Conductor Hambright, so many dollars," and that was all the formality there was about it. Checks for Baggage were not used, but when the cars arrived in Columbia or Philadelphia, the conductor would open the car door for the delivery of baggage, etc., to the passengers who crowded round and secured their parcels by answering "Mine," to the conductor's interrogatory, "Whose trunk is this?" which was kept up until all disappeared. If a trunk was marked "B," it was to go by boat; if "S," it was to go by stage line. Strange to say, there was not as much baggage lost then as now.

Very often the conductors would help the proprietors of the lines during harvest, and assist at other labor when off duty.—*New York Evening Post.*

Chicago Railroad News.

Wisconsin Central.

Mr. Scott, who is grading 64 miles of road from Menasha to Stevens' Point, has sub-let all this portion of the work. The ground has been so wet for the past few weeks that but little progress has been made so far. About 200 men are at work, and by the last of next week the contractors will have 1,000 hands on the 25 miles between Menasha and Wolf River. This 64 miles is to be graded and tracklaying to commence about the 1st of July, and by the 1st of September Mr. Phillips expects to have trains running to Stevens' Point. The iron is already purchased from the Cambria Iron Company, and weighs 57 pounds to the yard. All the ties are bought, and also all the locomotives that will be needed on this portion of the line. Messrs. Phillips & Colby are now contracting for the necessary cars.

An engineering party is locating another 50 miles of road west from Stevens' Point, and contracts for grading this section will soon be let.

Chicago, Burlington & Quincy.

The iron on the Fox River Valley road is now laid to Geneva, and for the past week the workmen have been engaged in surfacing and putting in order the track last laid, from Montgomery to Geneva. The road will probably be in a condition to admit of trains running regularly to Geneva by the latter part of next week.

The Mendota & Prophetstown Branch is in about the same condition. A daily freight train, with a way car, has been running for some time. Assistant Superintendent Hudson has been down arranging matters on the line during the past week, and it will not be long before regular trains are running over the new road.

Chicago & Alton.

The annual election was held last Monday. This company has nine directors, divided into three classes, the terms of only one of which expires yearly, so that the election is for three years. The directors whose terms expired last Monday were T. B. Blackstone and John B. Drake, of Chicago, and James G. Garner, of New York. The first two were re-elected, and in place of Mr. Garner, Mr. D. Willis James, of New York, was chosen. Of the 113,509 shares of the company, 78,351 were voted—all for the candidates elected.

The earnings of the company for the past month show the considerable increase of $128,000, or 13⅓ per cent., over those of the month of March last year.

The grading of the Louisiana Branch is progressing as rapidly as possible, and it is expected to complete it in about two months. Iron is waiting at Roodhouse, and opposite Louisiana, to commence tracklaying at both ends of the branch as soon as the grading is sufficiently advanced. The whole line from Roodhouse to Louisiana is to be completed by the 1st of July. There is also now at Louisiana two-thirds of the iron needed to lay the track from there to Mexico, Mo.

—The traffic receipts of the Great Western of Canada for the week ending March 10 amounted to £19,146, against £17,333 in the corresponding week of last year, showing an increase of £1,813—about 10 per cent.

RAILROAD GAZETTE

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Editorial Announcements.

Correspondence.—We cordially invite the co-operation of the Railroad Public in affording us the material for a thorough and worthy Railroad paper. Railroad news, annual reports, notices of appointments, resignations, etc., and information concerning improvements will be gratefully received. We make it our business to inform the public concerning the progress of new lines, and are always glad to receive news of them.

Inventions.—Those who wish to make their inventions known to railroad men can have them fully described in the RAILROAD GAZETTE, *if not previously published,* FREE OF CHARGE. *They are invited to send us drawings or models and specifications. When engravings are necessary the inventor is expected to furnish his own engravings or to pay for them.*

Articles.—We desire articles relating to railroads, and, if acceptable, will pay liberally for them. Articles concerning railroad management, engineering, rolling stock and machinery, by men practically acquainted with these subjects, are especially desired.

Engineering and Mechanics.—Mr. M. N. Forney, Mechanical Engineer, whose office is at Room 7, No. 72 Broadway, New York, has been engaged as Associate Editor of this journal in charge of these departments. He is also authorized to act as our agent.

☞ *Our Prospectus and Business Notices will be found on the last page.*

WATER.

There has been of late more than the usual amount of discussion on "watering" railroad stocks, and the process has been generally condemned as an abuse of the public which patronizes the railroads and pays the money which makes dividends upon "watered" and all other stock.

In this country it is common to call almost any increase in the stock of a company "water," unless it is directly subscribed and all paid in, it being taken for granted that no consideration is paid for it.

What inherent virtue or poison is there in stock dividends that they should be made by companies or denounced by the community? Do they enlarge the capacity of roads for traffic, increase their business or earnings, decrease their expenses, or in any way affect their condition, except in the figures representing their capital stock? Not in the least. If the Illinois Central should issue a 100 per cent. stock dividend to-morrow, the property would not be worth one cent. the more, it would not earn one cent the more, it would not be able to earn one cent the more hereafter: it would simply divide such an amount as it might earn by twice the present number in order to determine the dividend per share. The only effect stock dividends have or can have is upon men's imaginations, or as indications of opinions, previously withheld by those best informed, as to the earning capacity of the property. It would be otherwise if companies were limited as to the percentage of dividend they may pay. But they are not. There is nothing to prevent a company's paying a 100 per cent. premium annually, or quarterly, *if it earns it.* Some mining companies, we believe, do pay similar dividends. Not a few manufacturing companies pay 25, 50, and some 100 per cent. on the capital actually invested. Laws forbidding the watering of stock need not have the slightest effect on the profits of companies. It makes little difference to the stockholder whether he shall receive a 10 per cent. cash dividend and a 10 per cent. stock dividend this year, or a 11 per cent. cash dividend now and always hereafter. Unless it is pretty certain that the property will be able to earn the old dividend on the new and old stock, no one will be likely to give him more for ten shares of old and one share of new stock than he would have given for the ten shares before the new issue. A stock dividend is in effect a public announcement of increased capacity for profits. It does not alter facts; it simply declares a previously existing fact which may and may not have been generally known before. If it was not known, the market price—not the real value—of the property appreciates at once. If it was known, there is no change.

In many cases, doubtless, these waterings are made in order to avoid the prejudice and ill-will which, it is feared, might be caused by declaring an exceptionally large dividend. We believe this to be a somewhat weak evasion, and, moreover, it only puts off the clamor, and does not appease it. This is very evident just now, when journals and publicists, generally well-informed, take it for granted that in some way, which has been kept as secret as possible, the railroad companies have managed to procure great properties for a trifle, and now are exacting enormous profits on their actual capital.

Just how much should a railroad company be able to make? What should be the standard of reasonable profit on capital invested in roads and rolling stock? It is plain that a railroad company, as well as an individual (and sometimes more easily), may be extortionate. But what is extortion in their case? Surely it will not be argued that a single maximum rate of interest is applicable to all kinds of business. The whole current of men's habits and opinions denies the appropriateness of such a rule. Twenty rates of interest are paid on different securities sold the same day by the same broker, and no one sees anything wrong in that. There are modifying circumstances which govern the investor in every case. Englishmen have many millions invested in consols, which pay, at the present price of those securities, only about 3¼ per cent. Chicago & Northwestern stock has paid 10 per cent. this year, but it is not worth nearly so much as consols in London. But consols are considered by the great capitalists of the world as the safest and most permanent of all investments. They never pass a dividend, they are supposed to be as sound as the rocks which underlie the British Empire. The chief elements in determining a proper reasonable interest on an investment are the soundness and permanency of the investment and the regularity with which it may be expected to pay. If we put our money into a ditch which is to supply a camp of gold miners when, just as likely as not, the place will be abandoned in a year, and can hardly be occupied more than five years, we will want and will be justified in demanding a very large yearly profit on our investment. The element of uncertainty has very much to do in fixing the proper rate of interest. If we invest in mines in a country where half the mines are exhausted in a very few years, while others are apparently inexhaustible, all must charge for their product alike, and the profits, so long as mineral is abundant, must be very nearly the same in both kinds of mines. Now, if the inexhaustible mine is limited to a profit of 10 per cent. on the capital invested, the other can make no more, and if it fails at the end of five years, those who have invested in it will have lost $100 for every $50 they have received. We have assumed that the chances of success and failure are equal. Therefore, on the average, of every $10,000 invested in mining in that section, at the end of five years $5,000 would have earned $500 per year and disappeared wholly, and $5,000 would remain, after having earned $500. If 6 per cent. were the current satisfactory interest, there would have been a loss of $4,000 on one-half and a profit of $1,000 on the other, besides, probably, a stock in the successful mine worth 50 per cent. premium. Counting this premium, the man who had invested equally in successful and unsuccessful enterprises would have, at the end of the five years, $5,000 of mining stock worth $7,500; interest for five years above common rate $2,000; total $9,500; in place of the $10,000 with which he went into the business. Of course in such a condition of things, no capital would touch the business. Nothing but the chance of very large profits on a successful enterprise will induce men to put capital into a business where there is an equal chance that the investment will be entirely lost. Every man acts on this principle in his own business, but we are not always ready to acknowledge its applicability to the business of others, and especially of corporations. It is true that railroads are not so uncertain in their results as the mines in the case we have assumed; but they are very uncertain, as thousands of unfortunate investors in this country, and especially abroad, can testify from sad experience. So long as the general business of transportation by rail is uncertain in its results will it be right and proper and necessary (if we are ever to have any more railroads) that the successful roads should earn much more than the average rate of interest on money.

If we should divide the total amount of railroad dividends in the United States by the total amount of capital actually invested in them, we would find the average income on this uncertain investment not at all extravagant. Indeed, we believe it would be less than the ruling rate on the safest permanent investments.

Here in the West it is difficult to borrow money on good real estate security for less than 10 per cent. There is a market for millions of money at that rate. Some of our soundest and most prosperous interior towns offer their bonds bearing 10 per cent. for a term of years, and consider themselves fortunate if they can sell them at par. Can we expect capitalists to put their money into an uncertain enterprise, which may make no return at all and is hardly likely to pay more than a nominal dividend for some years at least, if they are forbidden to receive more than 10 per cent? Is it unjust for them to receive a large percentage from one successful enterprise, when three out of four in which they invest pay not more than 2, 4, or 6 per cent., if, indeed, they pay anything? How would such a principle apply to trade? A merchant will not do business at all if he is limited to a profit of 10 per cent. when he can get that interest on his capital without any risk. In trade he may not make 5 per cent.; he may lose money instead of making it. But he assumes the risk because he may make 25 per cent. or more. With railroads the risks are similar, and so is the right to make large profits.

Another matter to be considered is the form of investments of capital. When a railroad is constructed in a new country, it frequently pays no dividend for years. It is said to be "developing the country," and its owners, if remarkably patient and hopeful men, do not despair of their investment. Now while the million of dollars I have put into a new railroad is building up a country—and a business—what becomes of the interest? Shall it be sunk absolutely for the good of the railroad's patrons and become a dead loss to me? Is it anything more than justice to add that interest to the capital account and make the traffic of the road pay interest on it when it is large enough? If I receive no dividends on my million of railroad stock for five years, suppose I add 8 per cent. to the capital stock yearly. Then at the end of the five years I will have about $1,470,000 of capital stock instead of $1,000,000. But is there anything extortionate in this? This amount of capital has been used in the creation of the property, and it is but reasonable that the property should represent it. In this case—which is not an extravagant one—if yearly stock dividends were not made, it would be simple justice to the stockholders to make a 47 per cent. stock dividend at the end of the five years, and charge such rates as will enable the road to earn dividends on the whole. Would there be any extravagant profits in such a case? Can you find a capitalist who will lend you, on the most undoubted security, $10,000 without interest for five years on condition that he shall receive 10 per cent. yearly on $15,000 thereafter? We think not. Such cases as the one supposed above are very numerous. But if a company which has not paid any dividends for years should afterwards increase its stock and pay a fair dividend on it, there are hundreds in the community to say, and hundreds of thousands to believe, that the company is plundering the community to make extravagant profits.

Again, shall railroad companies be prohibited from sharing in a general rise of value of all fixed property in the country in which they may happen to be? Mr. Rufus Hatch, in a recent circular, charges that an increase of about $90,000,000 has been made in the capital of four of the most important of American railroad corporations. This he calls "water." How much of this can be accounted for otherwise we will not now stop to estimate; but it is worth our while to inquire whether there has been any "watering" of other property. Did it ever occur to these hydrophobists that land sometimes appreciates in value without a cent of capital expenditure? Not very many years ago the 350,000,000 of acres of land in Iowa could have been bought for $1.25 per acre, or less than $440,000,000. Nearly all of it was sold at that price or given away. At this day the average price of land in the State, *exclusive of all improvements*, cannot be less than eight dollars and is more probably ten dollars an acre. Taking the lowest figure, we have the total value of the land at the present time $2,800,000,000—showing the enormous "watering" of Iowa land stock, so to speak, of $2,360,000,000, or more than 500 per cent. And this is but a single instance. Within thirty years the value

—and the price—of the land of six or eight Northwestern States, *independent of all capital expended thereon*—has increased several hundred per cent., amounting in the aggregate to thousands of millions. And the interest on this advance is paid by the consumers of the productions of the soil. The corn raised on Illinois land worth $50 per acre costs much more than if the land were worth but $5 per acre, which was its price twenty-five or thirty years ago. This increase of cost is paid by corn consumers everywhere, who thus pay interest on the "watered" value of the farmer's real estate. But though this increase in value was in large part created by the railroads, any increase in their capital, without a corresponding direct expenditure, is condemned wholly, while the increase in the price of land, very frequently without the expenditure of a cent, is regarded as entirely legitimate, and a proof of a healthy general prosperity. The fact that every farmer profits by the rise in the value of real estate, and does not profit by the rise in the value of railroad property, explains the prevailing sentiment of the community. This is a community of land-owners, and not of railroad owners. If nine-tenths of the land in the country were owned in New York or England, the objection to a rise in its price would be much stronger than the prevailing prejudice against railroad profits. On the other hand, if every farmer owned two or three shares of railroad stock, he would be more likely to see the propriety of and be satisfied with occasional large profits. It is really unfortunate that so small a proportion of the stocks of our railroads are owned in the country in which the roads are situated. The average man is not likely to understand a business in which neither he nor any of his neighbors has any pecuniary interest. There is no such thing as a public opinion in support of the rights of railroad corporations, as there would be if any considerable part of the community were interested in them. If the community would secure such corporations in their rights, see that the laws provided a defense against the numerous schemes by which honest investors are robbed and deprived of the control of their property, and thus make the returns of railroads more regular and the risks very much less, then capitalists could and would be satisfied with a smaller average rate of profit, and it would be easy to obtain money at comparatively low rates of interest for the construction of new lines when they are needed.

ILLINOIS RAILROAD LAWS.

The House passenger bill, providing for a graduated scale of charges, and the Senate freight bill, providing that the freight charges on any road shall in no case exceed the rates charged in 1870, shall not be greater for any distance than for a shorter distance on the same line, nor greater per mile for any distance than for an equal distance elsewhere on the road, have passed both houses of the Legislature, and now await the Governor's approval. This comes very near fixing the freight charge at the lowest rate per mile at which freight was carried in 1870. If the Illinois Central carried cotton from Cairo to Odin for a dollar a car load in 1870, in order to get something for cars that went south full and must be hauled back whether full or empty, then, according to this law, that road cannot charge more than one dollar per car load hereafter for transporting freight 121 miles, or any less distance, and grain would have to be hauled to Chicago from all stations north of Champaign at that rate. So no more can be charged for hauling a car of freight 100 miles from one way station to another, leaving the car, perhaps, where it will not be wanted for months, than from a way station to a terminus where the car can be used immediately without further hauling. Of course, if any road maintained a ruinously low rate in 1870 by this law it must stand by its folly forever hereafter. The simple rule for ascertaining a legal charge will be: Take a freight tariff for the same day in 1870, and find the lowest rate charged for an equal or greater distance, in 1870. This will be the legal charge.

By the passenger law, the Chicago & Northwestern, the Chicago, Burlington & Quincy, the Chicago, Rock Island & Pacific, the Chicago & Alton, and the Illinois Central will be authorized to charge 2½ cents per mile for conveying passengers, whether the distance be great or small, provided that they may charge at least fifteen cents for the shortest distance. The Indianapolis & St. Louis and the Toledo, Wabash & Western may charge 3 cents per mile. The Ohio & Mississippi 3½ cents, the Toledo, Peoria & Warsaw, 4 cents. The Vandalia road, the Indianapolis, Bloomington & Western, the Rockford, Rock Island & St. Louis, the Springfield & Illinois Southeastern have not yet been operating long enough to establish their grade, and consequently, we suppose, are at liberty to charge the highest rate of 5½ cents per mile.

However, we do not imagine that any great effort will be made to ascertain the class to which a road belongs, for there will hardly be any attempt to obey a law of this character.

Indeed, we have reason to believe that the members of the Legislature who voted for these laws had, for the most part, no belief in their efficacy on their constitutionality. They were a tub thrown to a whale, very many of the members of the Legislature having that supreme contempt for the intelligence of their constituents which leads them to believe that a refusal to legislate where legislation must be ineffective will make them unpopular, and that the passing of laws in their nature absurd and unconstitutional will gain them favor. A well-informed correspondent writing to us from Springfield reports the explanations of votes which different Senators made when the freight bill passed, as follows:

"Bangs voted for it out of respect to the committee; Beveridge, because the people want some bill; Bush, because he could do no better, but he didn't think this bill worth a row of pins; Casey, because the bill resembled a church which a friend of his joined—it didn't interfere in politics or religion—so this bill interferes neither with the railroads nor the people; Fuller said he was never so embarrassed, etc., etc., but he wanted something, and sunk his pride of opinion, etc., etc. Kerr was reminded of a friend's method of dealing with calves:—he called one with a nubbin of corn, and when it came put a cob in its mouth. And the same cast of remark ran through the entire Senate. It was a most complete farce, so far as legislation is concerned."

If any good is to arise from the action of the Legislature, it must be from the Commissioners bill; but almost the entire value of that depends upon the characters and qualifications of the Commissioners. It seems to be taken for granted that they must be politicians, and this renders it extremely doubtful whether anything but harm will be effected by the Commission.

NEW PUBLICATIONS.

Travelers' Official Railway Guide.—This guide reached us promptly on the 1st inst. Excellent as it has long been, we find that it improves continually, and the current number appears to us the best we have ever seen. It contains a wonderful amount of matter, being a volume of 232 large octavo pages, each as large as three ordinary duodecimo pages, and so is altogether equivalent in surface to two or three ordinary bound volumes, while it is so closely and compactly printed that the actual amount of matter is two or three times as great. It is one of the marvels of book manufacture that so large an amount of matter can be published so cheaply. The three dollars which pay for a year's subscription to the *Official Guide* buy 2,800 large printed pages—twice as much printed matter as is contained in Dickens' complete works, and equaled, we believe, only by newspaper publications. But this is rather an indulging of curiosity than a notice of the *Guide*, which is not only a big book, but a very good one, most carefully and conscientiously edited, remarkably accurate, and more full and complete than anything of the kind ever published heretofore. A large number of the railroads are illustrated by maps, many of which were engraved by the National Railway Publication Company, which publishes the *Guide*, and has recently established the map department. These specimens of its work are extremely creditable—much better than most maps of the kind.

We need not say that the *Official Guide* is now indispensable to all travelers, giving them the fullest, latest and most accurate information of the running of all passenger trains on all railroads of the United States and British America.

Poor's Manual of the Railroads of the United States.—We are informed by the general agent for this work, Mr. I. D. Marks, that the edition for 1871-72 will be issued about the middle of May, and that an edition of 15,000 copies will be published. This work, we assure our readers, after almost constant use for two years, in one of the most complete and accurate of all periodical works of reference, and no man who has frequent occasion to find a statement of the stock, debt, earnings, dividends, names of officers and directors of railroads, etc., can afford to be without this comprehensive work.

Mr. Marks is now canvassing for this work in the West. Statistics of railroad companies or other communications may be sent to him at this office.

The Evening Mail, a seven-months-old child of journalism—male child, we suppose (pun)—has in that time grown so strong and hearty that it has left its old home and set up for itself at No. 106 Madison street, only two doors from the GAZETTE office, where, among other advantages, it has good company—the *Tribune*, the *Post*, the *Staats-Zeitung*, the *Union*, the *Western Rural*, the *Art Review*, and another very excellent neighbor whom modesty forbids us to name, being close at hand. Seriously, the *Mail* has grown fast and done well. It was the first cheap daily paper in the city, and it has always been fresh, lively and newsy, and therefore it is not to be wondered at that it has a very large list of subscribers in the city. Who will not take a daily paper when he can get one like the *Mail* for twelve cents a week?

Van Nostrand's Engineering Magazine for April has the following articles: Solar Heat—Its Influence on the Earth's Rotary Velocity, by Captain John Ericsson, Bronze Field Guns, Steel Tires, Coal Mines in China, American Locomotives, Locomotives *vs.* Portable Engines, and Rolling Stock for Narrow Gauge, from *Engineering*; The Mechanics of Flying, from *Der Civil Ingenieur*; The Steam Injector, from *Die Zeitschrift des Vereines Deutscher Ingenieure*; The Powers and Capabilities of War Rockets, Sewage Crops, The Sherman Process, from *The Engineer*; On the Selection of Building Sites, Rivers—Their Function and their Treatment, from *The Builder*; Theory and Details of Construction of Metal and Timber Arches, by M. Jules Gaudard, On the Strength of Lock Gates, by Walter R. Browne, Account of Floating Docks, by George Banks Rennie, On the Gibralter, the Gulf Stream, and the General Oceanic Circulation, by Dr. W. B. Carpenter, On Water Meters, by Frederick E. Bodkin, Limes and Cements, by H. E. Hunt—all papers or abstracts of papers read before British learned societies; The British Navy in 1871, being extracts from a pamphlet by Robert Main, published in London; Chrome Steel, from *The Iron Age*; Relations of Trains to Curves, by S. J. Wallace, from the RAILROAD GAZETTE An Account of the Removal of Some Broken Piles from the Bed of the Connecticut River, by J. Albert Monroe, a paper read before the American Society of Civil Engineers; Movable Bridges and Proportion between Strength and Size of Iron, from the *Mechanics' Magazine*; Determination of Purity of Metals by the Form of their Drops, from the *Polytechnische Journal*; Proof Strength of Chains, from the *Building News*; The Resistance of Fluids, from *Sonnet's Dictionnaire des Mathematiques Appliquees*, and Booth's Patent Rail, apparently an original article, which recommends unreservedly this peculiar steel-faced rail. There are also the usual "Iron and Steel Notes," "Railway Notes," "Engineering Structures," "Ordnance and Naval Notes," "New Books," and "Miscellaneous," filling about a dozen pages."

Baltimore & Ohio Railroad Report.

The Baltimore & Ohio Railroad Company owns the line of railroad from Baltimore west to Wheeling, W. Va., 380 miles. It leases and operates a branch from Harper's Ferry, 81 miles west of Baltimore, southward 51 miles to Strasburg, Va.; one from Hagerstown Junction, 79 miles west of Baltimore, northward to Hagerstown, 24 miles; one from Relay House, nine miles southwest of Baltimore, southwest 30 miles to Washington, D. C.; one from Grafton, W. Va., 280 miles west of Baltimore, westward to Parkersburg, W. Va., 103 miles; making a total of 588 miles operated east of the Ohio. It also operates under a lease the Central Ohio Railroad, from Wheeling west to Columbus, O., 137 miles, and the Sandusky, Mansfield & Newark, from Newark, 104 miles west of Wheeling, northward to Sandusky, 116 miles; making a total of 241 miles of road operated in Ohio. The total mileage operated is 829 miles. The annual report for the year ending September 30, 1870, gives an account in detail of the operations of the lines east of the Ohio. We give herewith a summary of that report:

The gross earnings of the main stem, including the Winchester and Potomac, Washington County and Winchester and Strasburg branches, have been $8,427,728.16.

The expenses of working and keeping the roads and machinery in repair, amounted to $5,453,460.00, being 64.7 per cent. upon the earnings, showing a decrease of 1.27 per cent. compared with the previous year.

It is shown that the earnings, in comparison with the fiscal year 1869, have decreased $297,187.58, and the working expenses have decreased $302,646.46, making a comparative increase in the net profits of $5,458.88. Compared with the fiscal year 1868, the increase of earnings being $869,083.65, and the increase of working expenses $399,011.27.

The liabilities of the company, compared with the statement of September 30th, 1869, have increased as follows:

Preferred stock, second series, 6 per cent.	$282,500 00
Sterling loan £800,000 @ $4.84 gold	3,872,000 00
Total	$4,154,500 00

The comprehensive policy of the company in opening and extending the great lines which have been aided and improved or organized under its auspices has required large investments of capital. In order to carry out promptly plans of the highest consequence for the promotion of the interests of the city of Baltimore, and the important cities and vast regions with which the system of improvements of the Baltimore & Ohio connects, it became desirable to secure capital more rapidly than could be realized from the annual surplus earnings of the company. The board, therefore, decided to obtain a loan of £800,000, which was negotiated promptly and successfully in July last, through Messrs. Baring Brothers & Co., London.

The following investments of capital have been made within a brief period, viz:

In mortgage bonds of the Marietta & Cincinnati Railroad Company, as re-organized	$1,400,000 00
In mortgage bonds of the Pittsburgh & Connellsville Railroad Company	1,000,000 00
In stock in Washington County Railroad	753,280 00
In stock and debt of the Winchester & Strasburg Railroad	596,663 66
In the Metropolitan Branch Railroad	800,671 40
In the Ohio Bridges	1,414,909 70
In Parkersburg Branch for arching tunnels	1,349,518 90
Total	$7,325,043 66

It will be observed that after deducting the entire sum received from the sale of preferred stock

and the sterling loan, more than three millions of the amount thus invested were derived from the earnings of the road in addition to which the increase of equipment, substitution of iron for wooden bridges, of steel for iron rails, the construction of double track, the erection of piers, wharves, and of extensive and costly buildings, to meet the requirements of business at various points, have all been paid from the revenues of the company.

It will be further noted, that the increased liabilities, for the past year, are $2,766,295.76 less than the aggregate of the amount heretofore paid from the earnings of the Baltimore & Ohio Company, of original mortgage debts, on the Baltimore & Ohio and Parkersburg Branch roads.

The profit and loss account shows an increase for the past year of $1,013,374.72. It will be seen by this account that the surplus fund, which represents the capital invested in the various branch and connecting roads, and the great improvements which have been continuously constructed on the main line, now amounts to $21,375,050.73.

The aggregate earnings, working expenses, and net results of the main stem, including the Winchester & Potomac and the Washington County branches, and the Winchester & Strasburg Branch, from July 1st, 1870; of the Washington Branch and Parkersburg Branch railroads; of the Central Ohio Division for the fiscal year, and of the Lake Erie Division from July 1st, 1869, to September 30th, 1870, were, viz:

	Earnings.	Expenses.	Net Earn'gs.
Main Stem	$8,427,728 16	$5,453,460 00	$2,974,268 16
Washington Branch	381,814 46	199,128 19	182,686 27
Parkersburg Branch	561,884 99	661,780 41	.....
Central Ohio Division	842,435 99	774,113 69	68,323 30
Lake Erie Division	626,506 88	419,152 49	207,354 39
Total	$10,840 370 48	$7,507,633 78	$3,432,632 12
Deduct deficit on Parkersburg Branch			99,895 42
Net results			$3,332,736 70

The gross revenue of the main stem and branches, including the Central Ohio and Lake Erie divisions is, thus shown to be $10,840,370.48.

The locomotive equipment at the main stem and branches at the close of the fiscal year 1869 consisted of 315 engines; to which there were added in 1870, 9—making a total of 324; of these, 62 were passenger and 262 tonnage; 277 were first-class, 38 second-class, and 9 third-class. On the Central Ohio Division there are 30 engines, and on the Lake Erie Division 9—making a total of 363.

The number of cars in service at the close of the fiscal year 1869 was 5,338; to which there were added in 1870, 299—making the total at the close of that year, 5,637; of which 164 were passenger, 27 baggage, mail, etc., 1 pay, 1 post-office, 1 officers', and 5,438 tonnage, stock and coal cars.

The mileage of engines in 1869 and 1870 was as follows:

	1869.	1870.
Main Stem	6,640,731	6,749,834
Washington Branch	418,895	429,686
Packersburg Branch	691,644	761,854
Total	7,751,260	7,941,374

The through tonnage, which amounted in 1869 to 199,873 tons, was, in 1870, 286,835 tons—showing an increase of 86,962 tons.

Twenty-two first-class passenger, 277 house, gondola, stock and other cars, and nine locomotives, being new and additional equipment, have been constructed at a cost of $385,577.87.

The expenditures upon the construction of the elevator and the Cumberland rolling mill; for the property on Mill street wharf, and for new and additional plant, amounting to $803,403.78, have been charged to the respective accounts of cost of road, real estate, and rolling power.

In July last, the Winchester & Strasburg road was completed. This road forms the extension of the Winchester & Potomac road from Winchester, nineteen miles to Strasburg, in Virginia. It there connects with the Orange, Alexandria & Manassas road, and thus opens the line through to Harrisonburg, 102 miles from Harper's Ferry. This line is destined to connect with the projected Valley road, which is to be a part of the great interior route, passing through most fertile and extensive regions, and which promises to become ultimately the great trunk line from Baltimore to New Orleans. The Baltimore & Ohio Company has invested in the Winchester & Strasburg Company, by its subscription to its stock and advances, $596,663.66. A contract has been made with that company for the lease of its road.

REGISTER OF EARNINGS.

FOR THE SECOND WEEK IN MARCH.

Michigan Central (284 miles), 1871	$83,381 87
" " (284 miles), 1870	76,451 19
Increase (9 per cent.)	$6,930 68

FOR THE THIRD WEEK IN MARCH.

Michigan Central (284 miles), 1871	$95,142 48
" " (284 miles), 1870	74,710 64
Increase (27½ per cent,)	$20,431 84
Chicago & Alton (511 miles), 1871	$97,506 06
" " (431 miles), 1870	88,307 26
Decrease (10½ per cent.)	$9,198 80
St. Louis & Iron Mountain (210 miles), 1871	$ 32,776 00
" " " (210 miles), 1870	23,847 00
Increase (37½ per cent.)	$8,929 00

FOR THE MONTH OF MARCH.

Chicago & Alton (511 miles), 1871	$1,068,222 60
" " (431 miles), 1870	940,042 64
Increase (13¾ per cent.)	$128,179 96

The Illinois Passenger and Freight Laws.

The following are the acts regulating the compensation of railways for the transportation of passengers and freight, passed by the Legislature and now in the hands of the Governor:

THE PASSENGER BILL.

A BILL for an act to establish a reasonable maximum rate of charges for the transportation of passengers on railroads in this State:

SECTION 1. Be it enacted by the people of the State of Illinois, represented in the General Assembly, That all railroad corporations organized or doing business in this State, under the laws or authority thereof, shall be limited to the rates of compensation for the transportation of passengers which are herein prescribed.

SEC. 2. All railroads in this State shall be classified according to the gross amount of their respective earnings per mile, as follows:

Class A shall include all railroads whose gross annual earnings per mile shall be $10,000 or more.

Class B shall include all railroads whose gross annual earnings per mile shall be $8,000, or any sum in excess thereof less than $10,000.

Class C shall include all railroads whose gross annual earnings per mile shall be $4,000, or any sum in excess thereof less than $8,000.

Class D shall include all railroads whose gross annual earnings per mile shall be any sum less than $4,000.

SEC. 3. All railroad corporations, according to their classifications as herein prescribed, shall be limited to compensation per mile for the transportation of any person, with ordinary baggage, not exceeding one hundred pounds in weight, as follows:

Class A, two and one-half cents.

Class B, three cents.

Class C, four cents.

Class D, five and one-half cents: Provided that no such corporation shall charge, demand, or receive any greater compensation per mile, for the transportation of children 2 years of age or under, than half the rates above prescribed: And provided, also, a charge of ten cents may be added to the fare of any passenger when the same is paid upon the cars, if a ticket might have been procured within a reasonable time before the departure of the train.

SEC. 4. All railroad corporations shall keep posted in a conspicuous place in its depots a printed copy of this act, with a table of distances between each and every station of its road, and a statement showing the class to which its road belongs.

SEC. 5. Any railroad corporation which shall charge, demand, or receive a greater compensation for the transportation of any passenger than is authorized by this act, shall be liable to the party aggrieved in the sum of $500, and the same may be recovered, together with the costs of suit and a reasonable attorney's fee to be taxed by the court, in an action of debt in any court having competent jurisdiction.

SEC. 6. If any final judgment shall be recovered against any such corporation, under the provisions of the fifth section of this act, a fifth time, such corporation shall be deemed to have forfeited all its rights, privileges, and franchises; and it shall be the duty of the State's Attorney in any circuit or county through or into which its road may run, to proceed against such railroad corporation so violating any provision of this act, upon information, in the nature of *quo warranto*, to judgment of ouster and final execution. In addition to the procedure herein provided, such corporation may be proceeded against in such other manner as may be provided by law.

SEC. 7. This act shall not be held to apply to any city or street railroad.

THE FREIGHT BILL.

A BILL for an act to prevent unjust discriminations and extortions in the rates to be charged by the different railroads in this State, for the transportation of freights on said roads:

SECTION 1. Be it enacted by the State of Illinois, represented in the General Assembly, That no railroad corporation organized or doing business in this State, under any act of incorporation or general law of this State, now in force, or which may be hereafter enacted, shall charge or collect for the transportation of goods, merchandise or property, on its said road, for any distance, any larger or greater amount as toll or compensation than is charged or collected for the transportation of similar quantities of the same class of goods, merchandise or property over a greater distance upon the same road. Nor shall any such railroad corporation charge or collect for the transportation of goods, merchandise or property over any portion of its road, a greater amount as toll or compensation per mile than shall be charged or collected per mile by it for the transportation of similar quantities of the same class of goods, merchandise or property over any other portion of its road of equal distance; and all such rules, regulations or by-laws of any such railroad corporation as fix, prescribe or establish any greater toll or compensation than is hereinbefore prescribed are hereby declared to be void.

SEC. 2. The term "railroad corporation" contained in this act shall be deemed and taken to mean all corporations, companies or individuals now owning or operating, or which may hereafter own or operate, any railroad in this State.

SEC. 3. No railroad corporation shall increase its rates of toll or compensation to be charged for the transportation of any property, from any point on its line of road to any other point on its line of road, by reason of any decrease in its rates which may be required to be made under the first section of this act; nor shall the rate of tolls or compensation on any day hereafter, charged or collected for the transportation of any property, from any point on its line of road to any other point on its line of road, be greater or more than that charged or collected on the same day and month in the year 1870, for the transportation of similar quantities of the same class of property, over the same part or portion of said road.

SEC. 4. Any railroad corporation which shall fix, demand, take, or receive from any person or persons, any greater toll or compensation for the transportation of goods or merchandise in violation of the provisions of this act, shall forfeit and pay for any such offence any sum not exceeding one thousand dollars and cost of suit, including a reasonable attorney's fee, to be taxed by the court, to be recovered in an action of debt by the party aggrieved, in any court having jurisdiction thereof. And any officer, agent, or employe of any such railroad corporation, who shall knowingly and wilfully violate the provisions of this act, shall be liable to the penalties prescribed in this section.

SEC. 5. Any wilful violation of any of the provisions of this act, on the part of any railroad corporation, shall be deemed and taken a forfeiture of its franchises; and such corporation so offending may be proceeded against by the State's Attorney in any circuit or county through or into which its road may run, by *scire facias*, or upon information in the nature of a *quo warranto* to judgment of ouster and final execution.

The General Ticket Agents' Convention.

The annual convention of general ticket agents was held at Savannah, Ga., on the 29th of March, the President, Mr. A. A. Barnes, of the Memphis & Charleston Railroad, in the chair. The following delegates were present;

Wm. Kirby, Alabama & Chattanooga.
W. J. Houston, Atlanta & West Point.
J. B. Bond, Atlantic & Gulf.
Frank Huger, Atlantic, Mississippi & Ohio.
L. M. Cole, Baltimore & Ohio.
J. W. Gore, Camden & Amboy.
W. F. Downs, Central Branch Union Pacific.
S. C. Boylston, Charleston & Savannah.
E. R. Dorsey, Charlotte, Columbia & Augusta.
J. F. Netherland, Chesapeake & Ohio.
Samuel Powell, Chicago, Burlington & Quincy.
H. P. Stanwood, Chicago & Northwestern.
E. St. John, Chicago, Rock Island & Pacific.
Samuel Stevenson, Cincinnati, Hamilton & Dayton.
G. M. Huntington, Cincinnati & Indianapolis Junction.
E. A. Ford, Cleveland, Columbus, Cincinnati & Indianapolis.
F. R. Myers, Cleveland & Pittsburgh, Erie & Pittsburgh, and Pittsburgh, Ft. Wayne & Chicago.
James R. Ogden, East Tennessee, Virginia & Georgia.
B. McChan, Erie.
E. N. Kimball, Brunswick & Albany.
E. Fitzgerald, Bay Line Steamers.
J. G. Tannatt, Cartersville & Van Wert.
E. Phillips, Providence & New York Steamship Company.
P. B. Tracy, Flint & Pere Marquette.
J. A. Robert, Georgia Railroad.
W. P. Johnson, Illinois Central.
N. E. Scott, Indianapolis, Bloomington & Western.
F. B. Papy, Jacksonville, Pensacola & Mobile.
C. P. Atmore, Jeffersonville, Madison & Indianapolis.
A. C. Dawes, Kansas City, St. Joseph & Council Bluffs.
L. C. Darte, Lackawanna & Bloomsburg.
J. W. Cary, Lake Shore & Michigan Southern.
L. S. Richardson, Little Rock & Fort Smith.
S. B. Jones, Louisville, Cincinnati & Lexington.
W. H. King, Louisville & Nashville and Memphis & Louisville.
S. K. Hooper, Louisville, New Albany & Chicago.
W. E. Davis, Macon & Brunswick.
J. W. Pillsbury, Mariettа & Cincinnati.
C. D. Whitcomb, Michigan Central.
D. B. Morey, Mississippi Central.
C. L. Fitch, Mobile & Ohio.
John S. Pollard, Mobile & Montgomery.
S. D. Hubbard, Montgomery & West Point.
W. L. Danley, Nashville & Chattanooga.
F. W. Rankin, New Jersey Railway & Transportation Co.
S. E. Carey, New Orleans, Jackson & Great Northern.
G. G. Sanborn, New Orleans, Mobile & Chattanooga.
D. P. DuShane, North Louisiana & Texas.
James Charlton, North Missouri.
Ellis Clark, North Pennsylvania.
S. E. Stockbridge, Florida Railroad.
R. H. Campbell, Knoxville & Charleston.
E. A. Flewellen, Macon & Western.
O. L. Cleaper, North Eastern.
J. M. Broadus, Orange, Alexandria & Manassas.
W. B. Hale, Pacific of Missouri.
H. W. Gwinner, Pennsylvania.
D. R. Dunn, Petersburg & Meldon.
Clinton G. Hancock, Philadelphia & Reading.
Geo. A. Dadmun, Philadelphia, Wilmington & Baltimore.
W. L. O'Brien, Pittsburgh, Cincinnati & St. Louis.
Thos. Badger, Raleigh & Gaston.
J. R. MacMurdo, Richmond, Danville & Piedmont.
J. B. Gentry, Richmond, Fredericksburg & Potomac.
H. T. Frary, Rome, Watertown & Ogdensburg.
F. Chandler, St. Louis, Vandalia & Terre Haute.
James W. Brown, Seaboard & Roanoke.
J. B. Peck, Selma, Rome & Dalton.
S. B. Pickens, South Carolina.
James Foggitt, Springfield & Illinois Southeastern.
J. V. Parsons, Toledo, Wabash & Western.
T. L. Kimball, Union Pacific.
B. W. Wrenn, Western & Atlantic.
Fred. Wild, Western Union.
Jas. W. Allen, West Jersey, Cape May & Milville.
A. Pope, Wilmington, Columbia & Augusta, and Wilmington & Weldon.
J. B. Yates, Rome Railroad.
E. B. Byington, St. Louis & New Orleans Packet Co.

Mr. Geo. A. Dadmun, was elected President; E. R. Dorsey, Vice President; Samuel Powell, re-elected Secretary, and Mr. W. P. Johnson, member of the Executive Committee, which now consists of W. P. Johnson, F. R. Myers and L. M. Cole. Rates were discussed, and several changes made on Southern lines. The only alterations in rates north of the Ohio River are between Chicago and Omaha, St. Paul and Cincinnati. These changes are to take effect on the first of May and will be announced at that time.

On the 30th ult., the members of the convention, most of whom had their wives with them, left Savannah for Jacksonville, Fla., and a trip up the St. John River.

—Judge Blatchford has granted the injunction, asked for by the English stockholders, against Fisk, Gould & Lane, and the board of directors of the Erie Railway Company, restraining them from issuing any more convertible bonds or stock of the Erie Railway Company otherwise than in exchange for genuine certificates of stock now in the hands of *bona fide* holders, until the further order of the United States Circuit Court, under penalty of $10,000.

—E. L. Wentz is the name of the General Superintendent of the Cincinnati & Indianapolis Junction Railroad, not E. L. *Wertz*, as our types had it last week.

—The traffic receipts of the Grand Trunk of Canada for the week ending March 11 amounted to £31,600, against £25,500 in the corresponding week of last year, showing an increase of £6,100, or about 24 per cent.

General Railroad News.

OLD AND NEW ROADS.

Detroit & Milwaukee.

The company's steamers, Lac la Belle and Ironsides, have been refitted and went into service on the first of April between Grand Haven and Milwaukee.

St. Paul & Pacific.

By telegraph we learn that this road, on which nothing was done last season, is to be extended to the Red River as soon as possible. The contractors will commence grading immediately. The distance from the present terminus at Willmar (105 miles from St. Paul) to Breckinridge is about 120 miles, but we believe the road is to make a junction with the Northern Pacific a little farther north.

Chicago & Southwestern.

The following are the names and distances from Leavenworth of the stations on the Western Division (Leavenworth to Cameron) of this road, which has lately been opened:

	Miles.		Miles.
Beverly	2	Edgerton	21
Cockrill's	5	Grayson	29
Tracey	10	Plattsburg	35
Camden Point	18	Camden Junction	54

With the 87 miles now completed between Washington and Centerville, on the Eastern Division, the company has now 141 miles of road. It is expected that the whole will be completed by the 1st of August next, when we will have a new route from Chicago to Leavenworth.

Atchison, Topeka & Santa Fe.

Trains are now running on this railroad to Cottonwood, 82 miles southwest of Topeka, and 20 miles west of Emporia. The stations and distances from Topeka are: Plymouth, 71 miles; Elinor, 76; Cottonwood, 82.

Missouri, Kansas & Texas.

The General Manager, R. S. Stevens, with a party, lately made a tour of inspection over the entire line, from Sedalia and Junction City to Chetopa. The iron is laid to 11 miles south of Chetopa and is progressing at the rate of a mile per day. The road is graded nearly to the Arkansas River. White oak ties and rails with fish-bar joints are used. The company have lately added 500 freight cars, ten locomotives and 8 passenger cars to their equipment. The new town of Parsons, the junction of the two divisions, contains about 300 houses, and the company are building machine shops there.

The stations and distances on the Osag a Division of this railroad, extending from Sedalia, Mo., southwest through Fort Scott, Kansas, to Parsons, the junction with the Neosho Division, 24 miles north of Chetopa, are as follows:

	Miles		Miles.
Sedalia	0	Walker's	83
Knightley's	7	Nevada	90
Green Ridge	12	Deerfield	100
Windsor	21	Fort Scott	111
Calhoun	29	Marmaton	118
Lewis	33	Hepler	131
Clinton	40	Walnut	137
Montrose	53	Osage Mission	145
Appleton City	59	Parsons	159
Rockville	67		

Trains on this division were in close connection with those on the Missouri Pacific. The distance to Fort Scott by this route from St. Louis is exactly 300 miles, whereas by way of Kansas City it is 370 miles. By the new route Fort Scott is but 28 miles further from St. Louis than is Kansas City. The distance to Fort Scott from Chicago is 587 miles by way of Quincy and Kansas City and 581 miles by way of St. Louis and Sedalia.

When the Louisiana & Missouri River Railroad is completed to the Missouri River, the construction of a line between 40 and 50 miles long would form a route from Chicago to Fort Scott about 525 miles long.

Rochelle & Rockford.

The engineer corps of the Chicago & Iowa Railroad has recently completed the survey of a route for a branch from Rochelle to Rockford—pretty much the same as that surveyed for the Rockford Central Company. The Chicago & Iowa Company was voted a subscription of $100,000 in aid of this branch, by Rockford, last summer. The people of Rockford, however, hoping to get this road through the Rockford Central, prefer that the Chicago & Iowa Company should build their branch to Sycamore rather than to Rochelle, connecting with the main line probably near Big Rock, about 12 miles west of Aurora. The company is now surveying this line.

Chicago & Rock River.

The President, Mr. Kinyon, announces that he will put the road under contract as fast as the right of way can be secured. The company is now purchasing ties, bridge timbers, etc., and iron is expected to arrive at Amboy about the middle of May, when Messrs. Hopkins & Co., contractors, will commence laying in both directions from that place.

Keokuk Railroad News.

Under date of March 29, a Keokuk correspondent writes:

TO THE EDITOR OF THE RAILROAD GAZETTE:

"The draw of our new bridge over the Mississippi here was swung round to day. The iron work is in place, and the first train is expected to cross a week from to-day. The bridge is built by the Keystone Bridge Company, of Pittsburgh, and is somewhat similar to that at Quincy, Ill. It is for both trains and teams, in a common passage way, with footways outside. This is said to be the first wagon bridge on the Mississippi. It is located just below the lower lock of the Government Canal, now building around the rapids here. The bridge connects two lines of road from the East, the Toledo, Peoria & Warsaw, and the Springfield route (Toledo, Wabash & Western); and two at present on this side, the Des Moines Valley road, running now to Fort Dodge, crossing all the east and west roads of Iowa, and pushing for its Minnesota connections, and now locating a branch from Oskaloosa west, and the Burlington & Keokuk Branch of the Chicago, Burlington & Quincy road; beside three more roads under way reaching north, west and south. A union depot is expected to be built this year, for the use of these radiating roads, on the levee here near the packet landing. A portion of them, at least, will have their main shops here. The Des Moines Valley Railroad already have extensive ones. They turned out a new locomotive, complete, last week.

Metropolitan Branch of the Baltimore & Ohio.

The New Washington paper, *The Capital*, gives the following description of the condition of this work: "The Metropolitan Branch is a concession of the Baltimore & Ohio Railroad to Washington, to be completed and to pass trains over its whole length by May, 1872. Two thousand men are now constantly at work upon this road, which is of very difficult construction, owing to the fact that it crosses all the hill ranges transversely, and it will, therefore, be delayed until sometime after its western complement, the Cumberland, Connellsville & Pittsburgh Railway, is open to travel.

"This branch, striking boldly across the country northwestward for forty-two miles, overtaking the Baltimore & Ohio old stem at Point of Rocks, will be of the greatest possible local advantage to Washington city."

The Capital hopes that handsome suburban towns will spring up in the handsome country on this new line, the old road to Baltimore having no desirable sites for such towns, and the city, consequently, has no suburbs of importance.

Prescott, River Falls & Northern.

The Wisconsin Legislature has granted a charter for a road with the above title, to run from Prescott, near the mouth of St. Croix River, northwest about 12 miles to River Falls, and thence in the same direction to a connection with the proposed line of the West Wisconsin Railway.

Albia, Knoxville & Des Moines.

This is an Iowa railroad nearly parallel with the Des Moines Valley Railroad, on which considerable grading has been done. The Board of Dirictors promise to have the cars running from Albia to Knoxville, 25 miles, by the 1st of September.

St. Louis Street Railroad.

The annual report of the President, Mr. John F. Madison, shows that the gross receipts for the year ending February 28, were $231,937.05, which is $6,519.42 in excess of those of the preceding year. The net earnings were $58,656.77, being $8,804 more than last year. The expense of operating the road was $173,280.28, or $2,285.52 less than last year, notwithstanding an increased number of horses to feed and an additional number of cars in operation. The operating expenses for the year just closed were 74¾ per cent. of the gross receipts, and for the previous year were 75 4-5 per cent. The number of passengers carried during the year was 4,782,433.

Rockford Central.

Week before last a corps of engineers was sent out to make preliminary surveys between Rockford and Rochelle, twenty-five miles. They returned last week, having surveyed one line from Rochelle to Rockford, and the greater part of another. An officer of the company informs us that it is expected that the grading will be commenced at once, and that there will be no delay in executing, and also that surveys of the entire route will be made at an early day.

Muscatine Western.

Mr. M. H. Chamberlain, General Agent of the Rockford, Rock Island & St. Louis Railroad Company, is canvassing the counties on the line of the Muscatine Western, with a view to securing such aid from them as will warrant the construction of the road at an early date. The route of the road will be from Muscatine due west to Council Bluffs, dividing pretty equally the territory between the Chicago, Rock Island & Pacific and the Burlington & Missouri River roads, which are from thirty to forty miles apart. Probably Pella, Indianola and Winterset will be points on the line.

Pacific of Missouri.

The annual report, submitted to the stockholders on the 29th of March, shows the following results of the year's business. The gross earnings of the fiscal year ending February 28, 1871, have been as follows:

For transportation of passengers	$1,355,001.77
For transportation of express and freight	2,083,673.47
For transportation of mails	57,450.00
For transportation of miscellaneous	4,105.60
Total earnings	$3,500,230.84
The operating expenses and repairs (including $75,648.21 Eureka accident) were	2,554,841.45
Net earnings	$945,389.39

The Eureka accident, whilst it is properly chargeable as a loss to the contingencies of operating the road, yet it is exceptional in its nature. If this be deducted from the running expenses, the account of the year would stand:

Total gross earnings	$3,500,230.84
Total expenses and repairs	2,479,198.24
Net earnings	$1,021,032 60
The gross earnings for the year ending February 28, 1870, were	3,256,356.78
The operating expenses were	2,371,447.94
Net earnings	$776,908.84
An increase in gross earnings of	341,874.06
And of net earnings of	244,123.76
During the past year the operating expenses and repairs were	70.83 per ct.
And during the previous year	75.08 per ct.

The President, in his report, says of the future financial policy of the company:

"With a view of placing the finances of the company in a more satisfactory position, by funding the floating debt, the officers of the company applied to the Legislature for such amendments to the general law as would enable them to accomplish that end. Our efforts in this respect were met in a liberal spirit, and the necessary amendments secured by which (with the consent of the stockholders) a second mortgage may be issued. It was obtained too late to be of any service during the past year, but must engage the attention of your board at an early day. In the opinion of your board, such a mortgage should be at once issued, to an amount sufficient to fund the debt, and to carry on the work of such permanent improvements as are demanded, and the provision of additional cars. The work in this direction, though carried on to the fullest ability of the company, during the past year, is far from complete. Much remains to be done, and if it is to be postponed until the means can be acquired from receipts, your percentage of expenditures must continue large for a considerable period. The prompt investment of the required amount now will enable its operations to be conducted at once at a much reduced rate, and save to the company far more than the interest of any amount required."

The company are now operating under leases four roads besides their own, viz: the Leavenworth, Atchison & Northwestern, the Osage Valley & Southern Kansas, the Lexington & St. Louis, and the St. Louis & Lawrence.

Grand Rapids & Holland.

A corporation with the above name was organized at Grand Rapids, Mich., recently, sufficient stock for the purpose having been subscribed. The election of directors resulted as follows: Thomas D. Gilbert, Freeman Godfrey, M. L. Sweet, L. H. Randall and John McConnell, Grand Rapids; M. D. Howard and Henry D. Post, Holland; Luman Jennison, Georgetown, and Horace O. Weston, Wyoming.

Portland & Rochester.

This company has contracted with George F. Hitchings of Portland, to distribute the sleepers, ballast the road and lay the sleepers from Springvale to Rochester. It is said that the road will be in running order by the middle of June through its entire length.

Baraboo Air Line.

The Baraboo *Republic* of the 29th ult. says: "Within from one to two weeks the road-bed across Devil's Lake and along its shore from the Mini-Waukan to Kirkland will be ready for ballasting and passable for wheeled vehicles. As soon as this is effected it is purposed to move the offices and headquarters of Messrs. Fox & Howard from Merrimack and the Lake to Baraboo, a change the more demanded in the interests of the construction of the road that it is now expected that contracts west of Baraboo will soon be let, thus making Baraboo the central point on the line of operations.

"It is again reported that it is expected to have the road in operation to Baraboo by September and to Reedsburg during the winter. That the road can be completed to Baraboo by the time indicated there is no doubt. Mr. Titcomb, in charge of the stone cut at the

Nose, says he can, if necessary, complete that job by the 1st of July. And by putting on a night force the steam scoop will make a way through the Gap, it is estimated, in some seventy days.

"It is more difficult to believe that the road will be running to Reedsburg next winter. With force enough, it can be done, though only with such effort as it is not safe to count upon."

Newark & Lima.

There is a plan to construct a railroad from Newark, at the junction of the Lake Erie and the Central Ohio divisions of the Baltimore & Ohio, in a northwesterly direction through Delaware, Marion and Kenton, to Lima, on the Pittsburgh, Fort Wayne & Chicago Railway, 59 miles east of Fort Wayne. Such a road would be about 120 miles long. A local paper speaks of it as an extension of the Baltimore & Ohio Railroad, and also as completing, in connection with the Fort Wayne road, an "air line" between Pittsburgh and Chicago. It could only form a Chicago & Pittsburgh route by uniting the Fort Wayne and the Pan-Handle roads, and so, to be available, it should be controlled by the Pennsylvania Company. But it would by no means make an air-line, being itself far from straight, quite 20 miles longer than the air-line, and the distance by it, the Pan-Handle and the Fort Wayne, from Chicago to Pittsburgh, would be 487 miles, 19 miles further than by the Fort Wayne road.

Central Pacific.

Travelers and others will find valuable the following tabular statement of the stage connections of the Central and Western Pacific railroads, which we take from the *Railroad Gazetteer*, a guide of the Pacific coast:

From	To	Miles.	Leave.	Time.	Fare.
Bantas	Mahoney's	34	12 00 M.		
"	Hill's Ferry	40	"		
"	Point Timber	28	"		
"	Antioch	36	"		
Stockton	Murphy's	61	6 00 A.M.	12 hours	$8 00
"	Big Trees	72	"	16 hours	10 00
"	Mariposa	100	"	26 hours	10 00
"	Coulterville	74	"	18 hours	10 50
"	Yosemite	109	"	32 hours	20 00
"	Columbia	69	"	13 hours	8 00
"	Silver Mountain	111	"	24 hours	16 00
Galt	Ione City	22	1 00 P.M.		2 75
"	Jackson	34	"		4 75
"	Sutter Creek	34	"		4 75
"	Mokelumne Hill	39	"		5 75
Marysville	Downieville	65	4 00 A.M.	12 hours	10 00
"	N. San Juan	28	6 30 "	8 hours	4 00
"	Portland	600	4 30 P.M.		40 00
Auburn	Michigan Bluffs	30	4 30 "	3 hours	6 00
"	Coloma	19	"		3 50
Colfax	Grass Valley	135	30 "	2 hours	2 50
"	Nevada	17	"	2½ hours	2 50
"	N. San Juan	29	"	5 hours	5 00
Dutch Flat	Nevada	17	6 30 "	3½ hours	2 50
Truckee	Lake Tahoe	14	7 00 A.M.	3 hours	3 00
"	Donner Lake	2			1 00
"	Sierraville	30	9 00 A.M.		3 00
"	Loyalton	38	"		3 00
Reno	Virginia City	21	7 00 A.M.	2½ hours	4 00
"	Carson City	32	7 00 A.M.	5½ hours	5 00
Mill City	Unionville	20	8 30 A.M.	3½ hours	4 00
Winnemucca	Camp McDermitt	80	10 00 "	15 hours	20 00
"	Silver City	208	"	34 hours	40 00
Battle Mountain	Battle Mt. Mines	7	2 30 P.M.	2 hours	2 00
"	Galena	13	"	3 hours	4 00
"	Austin	90	"	16 hours	20 00
Carlin	R. R. District	16	10 00A.M.	3½ hours	4 00
"	Mineral Hill	40	"	7 hours	8 00
"	Eureka	85	"	15 hours	20 00
"	Hamilton	118	"	22 hours	20 00
Toano	Egan Canon	93	6 30 A.M.	18 hours	18 00
"	Ely District	240	"		
Elko	Hamilton	130	7 00 P.M.	17 hours	25 00
"	Cope	85	9 00 "	20 hours	20 00
"	Boise City		"		
Kelton	Boise City	285			50 00
"	Baker City				80 00
Corrinne	Montana		6 00 A.M.		

Minnesota & Northwestern.

The Chief Engineer, Mr. H. W. Holley, in his annual report, gives the route of the road from Wells to Mankato, on which the grading is now about completed. The distance is 38 miles: "The route, as finally located, leaves the Southern Minnesota Railroad about 1,000 feet west of the depot of that road in the town of Wells, Faribault County, and thence practically on an air line *via* Minnesota Lake and Mapleton to the crossing of the Maple River, in the vicinity of Good Thunder's Ford. From this crossing the route is in nearly a northwesterly direction to the head of Red Jacket Ravine, thence down said ravine to the crossing of the Le Sueur River, which crossing is a short distance above the dam of the Red Jacket Mill; thence *via* Olanger's hog back, (a dividing ridge between the Le Sueur and a ravine terminating in the Van Brunt slough) to an intersection with the St. Paul & Sioux City road, a few hundred feet west of the so-called Van Brunt trestle on that road. Crossing the Sioux City road, the located line into Mankato follows the hillside upon the west side of the Van Brunt slough; thence crossing the Blue Earth Valley Turnpike over the brick yard, enters Mankato, and terminates on the Minnesota River near the business center of that city."

There are on the line two bridges, one of 240 feet and one of 175 feet; about 1,000 feet of piling; and, in Red Jacket Ravine, about 1,100 feet of trestle work, ranging in height from 25 to 40 feet. The maximum grade is 75 feet, but a grade of 50 feet is only exceeded once.

The President, in his report, says it is the determination to extend the road southward to the Iowa State line, in the direction of Fort Dodge, this year.

Burlington & Missouri River.

Iowa papers report that this company offers to construct a branch from Chariton, 130 miles west of Burlington, southwest 30 miles through Garden Grove and Leon, and thence south-southwest to Cameron, provided the country on the line will give the right of way and $4,000 per mile. The line would be about 150 miles long, and for most of the way would be nearly parallel with, and about 20 miles from, the Chicago & Southwestern.

Clinton & Kansas Branch.

Jackson County, Mo., in which Kansas City is located, has subscribed $300,000 to this branch of the Tebo & Neosho Railroad (now owned by the Missouri, Kansas & Texas Railway Company.) The subscription is made with the condition that the branch shall run from Kansas City, through Westport, in Jackson County, and Harrisonville, in Cass County, to Clinton, where it meets the Sedalia Branch of the Missouri, Kansas & Texas road. Here it will connect with the to-be-built Clinton & Memphis Branch, and the two branches will form the Kansas City & Memphis line.

Arkansas Central.

An officer of the company writes to us of this road, which is building from Helena to Little Rock, 100 miles: "Messrs. J. E. Gregg & Co., who have the contract for building the entire line, are vigorously pushing the work, having since January 1, prepared upwards of twenty miles for the iron. The road receives State aid to the extent of $15,000 per mile over the whole line; county, city and private subscriptions amounting to $500,000, and $150,000 acres of land. The route lies through high, gently rolling lands, entirely above overflow, and that portion of the road from Helena to White River, a distance of forty-five miles, will be completed and in operation by November 1, 1871. The company also propose to extend a branch line from their crossing on White River to Pine Bluff and Camden, which will place them in direct communication with the proposed South Pacific Railroad, and make it an important outlet to that road when built.

"The officers of the company are S. W. Dorsey, President; Hiram F. Hale, Manager; John J. Hornor, Treasurer; Jas. H. Seager, Secretary."

Quincy, Alton & St. Louis.

The directors of the company met at Quincy last week, and, the Burlington *Hawkeye* says, "perfected the arrangements for the construction of that road. Messers. John B. Alley, of Boston, and W. S. Wood, of Carlisle, Pa., were present at the meeting, and everything was amicably adjusted to the satisfaction of all concerned. Mr. Alley stated that he had advanced $125,000 for iron to Mr. Woods, contractor for this road, and that said iron had already been purchased, and would be arriving soon."

Midland Pacific.

This railroad is now completed from Nebraska City westward 40 miles, and is to be finished to Linc ln before the end of the month.

Texas Pacific.

The Board of Commissioners named in the act of Congress incorporating this company will open books for the subscription of stock at the office of the Southern Transcontinental Railroad Company, northeast cor ner of Warren and West streets, New York, on the 15th inst. The Commissioners are John C. Fremont, Marshall O. Roberts, Henry D. Cooke, John W. Forney, E. L. Faucher, Luther R. Marsh, Richard C. Parsons.

Prussian Railroad Dividends.

The Magdeburg-Lansitzer Railroad Company, in advertising in London for subscriptions of £750,000 to its stock, gives the following list of Prussian roads paying gold dividends: Halle, Erfurt & Guntershausen Railway pay 9 per cent.; Ludwigshafen Bexbach Railway pay 11¼ per cent.; Berlin, Hamburgh Railway pay 9½ per cent.; Ober Schlesische Railway pay 15 per cent.; Mainz Ludwigshafen Railway pay 9 per cent.; Berlin, Anhalt Railway pay 13½ per cent.; Magdeburg, Leipzig Railway pay 19 per cent.; Leipzig, Dresden Railway pay 24½ per cent.; Magdeburg, Halberstadt Railway pay 15 per cent.; Berlin, Potsdam, Magdeburg Railway pay 17 per cent.

Southern Pacific of California.

The San Francisco *Bulletin* of the 29th ult. says: "On the 1st of November, 1870, a trust mortgage was made between the Southern Pacific Railroad Company and D. O. Mills, of San Francisco, and P. C. Calhoun, of New York. The document states that the company desires to complete the construction and equipment of its railroad running from San Francisco through the counties of San Mateo, Santa Clara, Monterey, Fresno, Tulare, Kern, San Bernardino and San Diego, to some point on the Colorado River, in the southeastern part of California, a distance of about seven hundred and twenty miles, and to that end is about to issue its first mortgage bonds upon the road, its rolling stock, fixtures and franchises.

"At a meeting of the Board of Directors of the company, October 12, a resolution was passed directing the issuance of the first mortgage bonds upon the railroad —to the number of 41,000; 28,000 of which to be for the sum of $4,000 each; 8,000 for the sum of $500 each, and 10,000 for the sum of $100 each; all bearing date on the 1st day of November, 1870, payable on the 1st day of October, 1901, bearing interest at the rate of 6 per cent. per annum from the 1st day of April, 1871, payable semi-annually, on the 1st day of October following, and on the 1st day of April and October in each year thereafter, both principal and interest payable in United States gold coin, in the city of New York. The board also directed the form and manner of drawing up the bonds. The bonds amount, in the aggregate, to $28,000,000. The mortgage is signed by C. Crocker, President of the Southern Pacific Railroad Company, and J. L. Willcutt, Secretary of the company. It has been filed in all the counties through which the road will pass. The date of the record in San Francisco is March 15."

Berlin & Waupaca.

The Waupaca *Republican* says that a survey of a line from Berlin (the terminus of a short branch of the Milwaukee & St. Paul road) northward about 28 miles to Waupaca will soon be commenced, and that the work of construction will be begun immediately afterwards.

Lafayette, Bloomington & Mississippi.

The Bloomington (Ill.) *Pantagraph* is informed by one of the committee who visited the East, in the interest of the Lafayette, Bloomington & Mississippi Railway, that they succeeded in finding reliable parties who will enter into a contract at once for the completion of the road the present year. The road is now all ready for the rails.

Baltimore & Potomac.

The Washington *Star* says this company has just entered into contract for the heaviest steel rails for the road between that city and Baltimore, and will shortly begin to lay them from both ends of the road. The ties are now being delivered.

ELECTIONS AND APPOINTMENTS.

—The following officers have been elected for the Cincinnati & Rockport Railroad: President, Josiah Kirby; Vice-President, E. H. Sabin; Secretary and Treasurer, H. H. Tatell; Attorney, Judge H. O. Debruler; Executive Committee, A. T. Goshorn, Jos. McGlenn, P. P. Lane.

—E. W. Woodward, of Morrow, O., who was President of the Little Miami Company three years ago, has been chosen President of the Indianapolis & St. Louis Railroad Company. He was the candidate of the Pennsylvania Railroad Company.

—At the annual meeting of the stockholders of the Chicago & Alton Railroad Company, held in Chicago on the 3d inst., an election was held for three directors for a term of three years, in place of T. B. Blackstone and John B. Drake, of Chicago; James G. Garner, of New York, whose terms expired that day. By a unanimous vote of the 78,351 shares represented at the meeting —more than two-thirds of the whole amount—Messrs. Blackstone and Drake were re-elected, and D. Willis James, of New York, was chosen in place of Mr. Garner.

—At the General Ticket Agents' Convention, which met in Savannah last week, the following officers were elected for the ensuing year: President, George A. Dadmun, of the Philadelphia, Wilmington & Baltimore Railroad; Vice-President, E. R. Dorsey, of the Charlotte, Columbia & Augusta Railroad; Member of the Executive Committee, W. P. Johnson, of the Illinois Central Railroad. Samuel Powell, of the Chicago, Burlington & Quincy, remains Secretary, as a matter of course. The next meeting is to be held in Philadelphia.

—The directors of the Allegheny Valley Railroad Company have elected the following officers for the ensuing year: Col. W. Phillips, President; Jno. Ballantine, Esq., Controller; Capt. W. A. Tomlinson, Secretary and Treasurer; A. T. Rowand, Auditor; Col. J. J. Lawrence, General Superintendent; Thos. M. King, Assistant Superintendent; Capt. H. Blackstone, Chief Engineer; S. J. Jackson, Resident Engineer.

—The directors of the Maine Central Railroad Company have elected Edwin Noyes, Superintendent of the road, and Levi L. Lincoln, Assistant Superintendent; Joshua Nye, Financial and Purchasing Agent; J. S. Cushing, Treasurer; A. T. Thompson, Assistant Treasurer; Joseph W. Clapp, General Ticket Agent, and A. Hersey, General Freight Agent.

OHIO & MISSISSIPPI RAILROAD.

Report for the Year 1870.

The Ohio & Mississippi Railroad extends from Cincinnati westward across the southern parts of Indiana and Illinois to the Mississippi River at East St. Louis, a distance of 339 miles. It has a branch extending from North Vernon, 73 miles west of Cincinnati, southward to Jeffersonville, 53 miles. Its total length is thus 392 miles. It affords direct broad-gauge routes between Cincinnati and Louisville and Cincinnati and St. Louis. The following statements are from the last annual report of the company:

Earnings.	1870.	1869.	1868.
Passengers	$1,248,137	$1,192,030	$1,230,981
Freight	1,789,159	1,567,497	1,586,818
Express and mail	155,859	156,019	146,239
Total	$3,188,137	$2,915,547	$2,964,010

Showing an increase over the business of 1869 of the sum of $272,589.58 (9⅓ per cent), and nearly the same amount over 1868. This increase is in part the benefit derived from the business over the Louisville Division, which is included in the earnings of 1870. This branch of the road was opened for traffic the 1st of April last, and added to the receipts for the nine months' operations the sum of $89,863.32, and contributing to the business of the main line the sum of $145,216.48.

The following statement exhibits the expenses incurred and paid (both ordinary and extraordinary), charged under the following heads:

Maintenance of way and structures	$609,173
Motive power and cars	374,785
Transportation expenses	954,847
General expenses	99,095
Taxes—municipal and government	77,962
Damages to property and passengers, etc	34,860
Ballasting road bed, etc	57,604
Wood and water stations, water supply, etc	6,848
Fencing the road	8,348
Equipment passenger and freight cars, etc	117,903
Interest on loans, legal expenses, etc	37,193
Purchase of common stock, to take up trustees' certificates, in excess of authorized capital presented for conversion during the year, leaving to be provided for $196,601.44 of common certificates	33,802
Coupons of interest on bonds	443,676
Interest on preferred stock	295,276
Total	$3,151,368

There have been issued and sold during the year $382,000 of consolidated mortgage bonds, and $310,875.38 of preferred capital stock. The bonded debt of the company is comprised in the following items: Old bonds of the first and second mortgages, etc. (ultimately to be exchanged for the new consolidated bonds, of which $4,000,000 was reserved for that purpose), amount to $3,672,000, and consolidated bonds amount to $2,862,850, including sterling bonds held in London; making a total of mortgage bonds now outstanding the sum of $6,584,850; this includes the amount appropriated to the construction of the Louisville Division.

The preferred capital stock (also including the amount appropriated to the Louisville Division) amounts to $4,030,000.

A statement of the cost of the Louisville Division (53 miles) shows it to have been $1,822,289.

The number of locomotives owned by the company was 87, five of which were wood burners. The car equipment consisted of 3 parlor, 4 night, 1 officer's, 36 first-class passenger, 1 paymaster's, 4 mail, 16 baggage, 8 express, 1 express stock, 40 caboose, 678 box freight, 92 stock, 156 high flat, 107 low flat, 357 coal, and 4 tool and wrecking cars; a total of 1,448, of which 147 need repairs.

STATEMENT OF PASSENGER BUSINESS FOR 1870.

	No. passengers.	No. carried one mile	Receipts	Rate per mile, in cents
TO AND FROM FOREIGN ROADS.				
Through (bet. St. Louis and Cincinnati)	31,553	10,728,020	$307,950	2.87
Way	38,138	5,776,253	207,278	3.59
LOCAL BUSINESS.				
Through (bet. St. Louis and Cincinnati)	12,129	4,121,480	134,770	3.27
Way	302,701	12,283,148	531,217	4.32
AGGREGATE.				
Through (bet. St. Louis and Cincinnati	43,675	14,849,500	442,721	2.98
Way	340,839	18,059,401	738,095	4.09

CHAS. E. FOLLETT, General Ticket Agent.

STATEMENT OF FREIGHT BUSINESS FOR 1870.

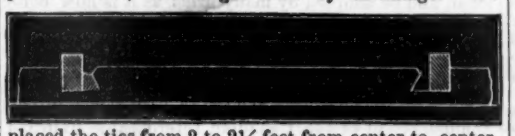
	No. of tons	Tons carried 1 mile	Receipts	Rate per mile, in cents
THROUGH TRAFFIC.				
East	90,919	.....	.....	....
West	89,052	.....	.....	....
	179,971	53,638,464	$789,127	1.47
LOCAL OR WAY.				
East	140,925	.....	.....	....
West	344,780	.....	.....	....
	484,705	34,515,590	1,000,012	2.90
AGGREGATE.				
Through (bet. St. Louis and Cincinnati to Jeffersonville)	484,705	.....	.....	....
Way through	179,971	.....	.....	....
	664,676	88,154,054	$1,789,139	2.03

A table of the gross earnings for the past thirteen years shows a gradual increase from $1,473,310 in 1858 to $3,793,005 in 1865; then $3,385,83 in 1866; $3,459,319 in 1867; $2,964,040 in 1868; $2,915,547 in 1869, and $3,188,137 in 1870. The average increase in mileage in 1870 was 40 miles, or 11.8 per cent., which is about one-fourth greater than the increase in receipts.

Wooden Railroads.

J. M. Speer, Sr. & Sons, of Warrick County, Ind., writing to the *Scientific American* give the following account of their experience with a wooden railroad:

In your valuable paper of February 4th, in the "Correspondence" column, I notice that you would like to hear more in detail about the wooden railroad. We built, in 1865, a wooden railroad, 3 $\frac{88}{100}$ miles in length, to transport coal, by mule power, to the Ohio River, near Rockport, Ind. The cross ties were mostly split out of white oak, from 7 to 7½ feet in length; and the notches were sawn with hand saws, as shown in engraving. They were cut straight down on the outside, and bevel and taper inside, to keep the keys in their places if they should get loose by shrinkage. We



placed the ties from 2 to 2½ feet from center to center. We used the best white-oak rails 3 × 6 inches, and keyed them in with oak, so that the bevel space was filled.

The cars used on this road had 24-inch wheels, 4-inch tread, 1½ inch depth of flange, and 2¼-inch axles, run in cast boxes lined with Babbitt metal. The weight of car was about 1,500 pounds, to carry 60 bushels coal — 4,200 pounds (the Indiana bushel is 70 pounds); in all about 3 tons per car. The cars ran smoothly and easily for six months, when the rails began to get soft, and to splinter for a quarter of an inch of depth. They were much the worst where the sun shone on them, during the summer months. About two miles of this road was through timbered land, and the rails in the shade lasted much better than those exposed to the sun.

The next trouble we encountered was in frosty weather; the splinters or mashed wood would stick to to the wheel, and wind around it like rope, until it would run out with the grain of the timber or break off at a knot.

In less than twelve months the road was rough, and we turned the rails, and replaced some with new ones. Some of the rails were worn down more than an inch, leaving the knots nearly full up to the first measure. This made a rough road; and we concluded to try flat bar iron. We sent for ten tons 1½ × ⅜ inches, countersunk and punched for ¼-inch spikes. This worked so well that we put iron on the full length of the road.

By using iron on the rails we gained as follows: 1st. On the wooded road we had to keep two or three men to keep it in order; as soon as the iron was on, one hand did the work, and had half his time for other work. 2nd. One mule would do as much work as three would do on the wooden road, and the rails would last about four years, or until they would rot and not bear the weight of the cars.

The vein of coal at this place being about worked out, we opened a vein near Yankeetown, Warrick County, Ind. This vein is about 20 feet above the Ohio River at high-water mark, and 8,530 feet from its bank. We built a road to the river last summer and fall. About 6,000 feet of this road is trestle work, on river bottoms, from 3 feet to 16 feet high, 10 feet span, 20 feet string timber (6 × 11 in white oak). The old flat bar iron and cars are used here. We used a piece of flat bar iron, about 18 inches in length, alongside of the flat bar at every joint, so that the ends of the iron are not mashed down into the timber to make it rough. This road is properly graded, the steepest grade with the loaded cars being 9 inches to the 100 feet. Three mules bring five cars up this grade, which is on trestle work, 10 feet high, planked with 2-inch lumber. We are not in full operation yet, but expect that one team of three mules will haul from 2,000 to 2,500 bushels per day to the river. We shall put on a small engine, as soon as we are able and find one to suit us. A six-ton engine would do our work, we believe.

The flat bar iron cost us near $1,100 per mile; ties, about 12 cents apiece—we used our own timber. (Cutting ties cost 5 cents; sawing notches and trimming out, 5 cents; hauling out of woods, 2 cents). We had to purchase some oak lumber, not having enough on our own land. Price paid was $16 per thousand, delivered along the road. We used near 325 thousand feet of lumber on the road and a few miners' shanties. Our vein of coal is from 4 feet to 4 feet 2 inches thick (what miners call "blasting coal.")

All that we can say to those building wooden railroads is, they will not be long in using flat bar-iron on their roads; by so doing, they will save many a dollar in the way of repairing rails, etc.

Narrow gauges and light T iron will take the place of the wooden roads in a short time, if cheap railroads are wanted. The T is a little more expensive at first, but in two year,s time it will pay for the difference in keeping the road in order.

[We are informed by a person who has had considerable experience with wooden railroads that oak is entirely unfitted for rails, but that maple and black birch maintain a smooth surface, wear well and are generally quite satisfactory when used for this purpose. Any of our readers who have had experience with such roads will do us and many others a favor by informing us of the value of different kinds of wood for such uses, and their durability. A road lately laid with wooden rails in Florida and used for passenger traffic is said to have become exceedingly rough after a few months use.—ED. RAILROAD GAZETTE.]

Railway Tires.

Next to fires, the easiest forms of disaster to classify are railway accidents, certain seasons almost invariably bringing particular descriptions of misfortune. The excursion season has its set, foggy weather, and is responsible for a share, and last but not least, severely frosty weather adds no inconsiderable quota to the list for any given year. Men of science, be they doctors or engineers, differ in their views, and it is only of late years that the members of the latter profession are becoming at all unanimous on the subject of the influence for evil exerted by hard frost on railway lines. The arguments of those who denied the practical effect of any but extreme temperatures were based on the fact that iron had its tensile strength but little affected by ordinary winter frost in this country, so far as special experiments with testing machines were concerned. Facts, however, are stubborn things, and it is vain to say that frost cannot be the cause so long as tires and axles break more frequently in cold than in warm weather. A little investigation, too, will go to show that experiment and practice, in the real sense of the terms, do not materially differ in results. It is one thing to suspend a bar of iron with a given load attached thereto, the thermometer recording so many degrees of frost, and quite another to set a railway wheel in rapid motion over a rail. In fact, the whole nature of the relative conditions are essentially different. To begin with, the strain of the tire from tension is almost unknown in magnitude. No two tires are shrunk on with the same amount of tension; no two are precisely alike in their chemical constituents. Again, a large allowance must be made for the influence of a frozen road; the metals during a severe frost have no particle of elasticity, and here is a source of fracture. To gain an idea of the different aspects of the question in frosty, and in summer or damp weather we should suspend two rods and strike the one with an iron bar and the other with a bar of lancewood, or, better still with a bar of whalebone. We find Russian and American engineers ready enough to acknowledge the effects of severe climates on their rolling stock, but really, when we come to examine the question, we find that it contains room for much more investigation than it has yet received. For example, what do we know of the influence exercised by various forms of springs on the durability of tires? To take a goods truck and a first-class carriage would be but an imperfect comparison, because of the different nature and conditions of their work. One-half of its running time, a goods wagon wheel is loaded to its full amount, the rest of its time it is running comparatively idle; as a rule, too, its speeds are lower than those of the carriage. The single fact that the two vehicles afforded examples of the best and the worst forms of springs would not be enough. Another point again that might well be investigated is the influence exercised by different methods of construction of wheels on the durability of the tires. Were we to have these sorts of accidents oftener, the influence of temperature would possibly be better examined into, and yet, even as it is, and setting aside the matter of life and limb safety, the question is one of interest from the abstractedly scientific point of view. Metallurgists well know that the presence of phosphorus in ever so minute a quantity will render iron cold-short, so much so, indeed, that a smart blow will break a bar containing any without any question of fatigue of metal being involved at all. It is quite reasonable to suppose that, if a certain proportion of phosphorus render iron cold-short where the difference of temperature lies between melting or welding point and ordinary weather temperature, a different proportion may have influence when the temperature is greatly reduced. That, however theorists may deny the influence of cold on wheel tires or axles, railway companies are believers in it, we may gather from the fact that during severe weather the speed of fast trains is diminished. It is a pity that there is no published register of the lives of tires and axles, with a statement of the methods of construction, the speeds, and the nature of the work each had been called upon to perform. Wheels which have wood interposed between the tire and the axle ought to be more durable and less liable to fracture than those without an elastic medium between the two, yet we have no record of the relative number of broken tires on the two types of wheel. Railway companies probably keep some such register to a certain extent for their own information, but we fancy it must be but an imperfect one. We wonder why the same plan of hooping railway wheels has not been adopted as that used for securing the rims of artillery wheels. There is no necessity whatever that railway wheel tires should work in a constant state of tension. The duties of a tire on a cart wheel consist in keeping the felloes together and on the spokes, but a rail tire has not such duty to perform. In point of fact, the tread of the wheel should have no duty whatever to perform, but to take the wear of rolling on the rail and nothing else. Railway wheels, even to this day, are made too much on the principle of common wood wagon wheels, while the relative structures of the two types of wheel have nothing else in common. It may very reasonably be asked why is a railway wheel tire shrunk on at all? Not to force the parts of the wheel together, as in the wood wheel; not to secure the tire itself in its place, because it has no reliable effect of the kind. To what other purpose, then? To none but the evil one of putting the tire in a constant fatiguing state of tension, injurious to the metal of the tire, without any compensating beneficial effect. Many ways are to be found of constructing a wheel that will sustain a load without any hoop, and on this a hoop could be so secured as to form, not a circular girder, but simply a wear and tear band, which could be removed without difficulty. Why should not a wheel with rim, spokes and flanch complete be forged in one solid piece, and afterwards a thin steel hoop be placed on the tread of the wheel, and secured with a few rivets; this could be taken off when worn and a fresh one put on; this, too,

could be effected without the cost of turning the tires on the wheels in the lathe, as they could be turned and bored true, and the wheels being turned true also when first made, the rim could be put on and riveted. Even did this outer hoop give way, there would be but little chance of the train getting off the rails, as the wheel itself with its flanch would be capable of bringing the train in safety to a station. The great evil of engineering is the proneness of its disciples to travel in a groove—to copy, or to adapt old cloth to the new garment. It is true that experiments are inadmissible where human life is concerned, but experiments can be carried out with goods rolling stock at first, and afterwards with passenger carriages. From the pecuniary aspect, the question is worth dealing with, on account of the heavy bills for compensation paid by companies. There is one point that might perhaps prove objectionable to the thin-tire plan. The rolling action on the rail tends to stretch the tire, and thereby enlarge its diameter, and thus loosen the hoop, but this question could alone be determined by actual experiment. The use of wood in wheel construction has increased of late years, and few fast trains are made up now with any other style of wheel. Indeed, the idea of hooping a rigid iron wheel which is called on to endure much hard work of a concussive nature, with a band shrunk on, appears rather an unscientific proceeding. Tires fail both from the fatigue of constant tension and concussion, and also from the strains caused by difference of speed between the two wheels on one axle in passing round sharp curves. Any means whereby loss of life and property from broken tires is prevented is well worth the cost of a few experiments, and the increased immunity from accident and its attendant expenses would well repay the first outlay.—*Mechanics' Magazine.*

Co-operative Labor.

Messrs. Fox, Head & Co., of Middlesbrough, have been striving for several years past, and apparently with no little success, to steer clear of some of the great difficulties that beset the employers of labor on a large scale, and how their system works it is possible to judge from the report of the meeting that was lately held in Middlesbrough, and at which there was a general assemblage of the workmen employed by Messrs. Fox, Head & Co., who themselves presided. We have on a previous occasion sketched out the plans which have been introduced into the Newport Rolling Mills, but we may again allude to them. It is now four years since the owners of these works commenced a system of co-operation by which their employes are entitled to share in certain of the profits accruing from their business. The following clauses, extracted from their code of rules upon the subject, give a clear insight to their system:

12. If at the end of any year *any surplus profit* remains, after paying all wages and salaries, and providing for interest on the capitalists' outlay, depreciation, renewals, bad debts and all other expenses of and incidental to the manufacture, the same shall be *divided into two equal parts;* the *one to belong to the capitalists* as their profit, *the other to be divided* among all those who have received wages or salaries during the year, in proportion to the amount so received by them.

13. Messrs. Fox, Head & Co. shall appoint a firm of *public accountants* of recognised positions, who shall annually *audit the accounts* and issue a *report* upon the same, stating whether the provisions of the scheme have been adhered to, and whether any, and what, profit has been made subject to division.

15. Any profit declared by the accountants to be payable in respect of any year's manufacture shall be *paid* at the pay office of the works, *within one month* after the date of the certificate of the said accountants; but at the expiration of the said month *all sums not applied for* will be liable to be *forfeited*, pursuant to rule 17.

16. The employes who may have served for *any portion of any year*, not being less than *one hundred full shifts* or days, shall be entitled to *participate proportionately.*

It will thus be seen that the workmen are made direct participators in the profits arising from the business of their employers; such profits being reckoned after the working partners have received certain salaries, after 10 per cent. has been paid upon the invested capital, and when 1½ per cent. has been set aside to cover any bad debts that may be made, the depreciation of plant and the cost of repairs being also deducted. Whatever profit may remain, after all these amounts have been set apart, is divided into two equal parts, one of which goes to the proprietors, and the other is divided amongst the employes in a proportion varying with the individual rate of wages. Besides this, if it should happen that the balance shows a deficit, such deficit is to be made good at a subsequent period, when there are any residuary profits.

That the system is not only practicable, but that it possesses sterling merit, is proved by the fact that Messrs. Fox, Head & Co. continue to employ it, whilst their employes—after having received no bonuses for the first two years, obtained, at the end of the third term, an interest of 2½ per cent. upon their wages, and recently a second payment of 4 per cent.—appear well pleased with the arrangement. Of one thing there can be no doubt, that such a system is of immense benefit to Messrs. Fox, Head & Co. The bonus just declared amounted to over £1,600, being the moiety of a sum that, it may be considered, has been fairly saved by the employes through extra care and more honest work, so that whilst an ample return is secured upon invested capital and directing skill, there still accrues a further benefit to the employes to the extent of one-half of the savings effected Moreover, there exists another advantage. It is expressly stipulated that none of the men employed shall belong to any trade union, so that Messrs. Fox, Head & Co., who themselves undertake to abstain from joining any coalition of masters, enjoy also the advantage of having their works free from members of associationswhich have for their object the coercion of employers, and as the price of this advantage they have merely to pay their men money which would probably never have been accumulated but for the provident rules established at their works.

On the other hand, not only are the men themselves freed from the more than doubtful trammels of the trades' union, but they have an incentive given them to labor, and to economise in every way for their own benefit. The receipt of 54 weeks' wages in a year is no doubt a powerful incentive in this direction, while it has also the effect of keeping the employes more steadily in their situations, and checking a tendency to constant change. This, again, is a mutual advantage both to employer and employed, the effects of which can be hardly overrated.

It is easy to imagine the arguments with which the leaders of trades' unions seek to raise discontent with the system, and doubtless with more or less success; but so long as labor understands and appreciates this alliance with capital, and feels the substantial benefit arising from it, the co-operative system will continue to exist, and be adopted by many firms, as it is now being established by a few.—*Engineering.*

A New Pacific Railroad.

Some interest has been excited in Wall street by the announcement of the Canadian Interoceanic Railroad. Encouraged by the growing prosperity and rapid success of our Pacific Railroad connecting the Atlantic seaboard with San Francisco and the Orient, some British capitalists long ago projected a line to pass from sea to sea through British territory, from Halifax to Vancouver's Island. The scheme has been in abeyance; but on Wednesday, at Ottawa, Sir George E. Cartier, on the part of the Canadian Government, proposed in the House of Commons that any company undertaking the construction of the road shall be aided with $1,500,000 a year. The new Pacific Railroad enterprise having thus been formally adopted by the Government of the Dominion, doubtless with the sanction of the Imperial Government at home, it only requires that a dividend of five per cent. a year should be guaranteed on the whole capital; and the 130 millions of dollars which the road will cost could doubtless be easily raised in England. To this guarantee there is considerable opposition by the advocates of light taxation; and the subject has further complications by being connected with the rather unpopular measures for the immediate admission of British Columbia as an integral part of the Canadian Confederation. In the unsatisfactory state of the finances of the Dominion the opposition is very active, but its success is doubtful.

The railway will be 2,500 miles long. It is to be begun in 1873 and finished by 1881. The work is to go on simultaneously at both ends. By the new route British Columbia is to be connected with the Canadian railways by a road which will give England a short path to India and China over her own territory and subject to her exclusive control.

The route has not been fully surveyed as yet; but its general direction is along the 50th parallel, our Southern Pacific road taking the 32d parallel, the Northern Pacific the 46th, and our Great Central Pacific route the 41st parallel. The new Canada Pacific is to start from Bute Inlet, opposite Vancouver's Island, and to terminate at Lake Nipigon, to the northwest of Lake Superior. At Bute Inlet the harbor accommodation is very good. Crossing the Cascade Mountains at the Tete Jaune Pass, at a low elevation, the new road is to descend in easy grades down the gradual slope of the Saskatchewan Valley to Manitoba. This is the district formerly known as Prince Rupert's Land, surrendered by the Hudson's Bay Company last year, but not at once confederated with the Dominion. The population in 1869 of the whole terrritory comprised in British Columbia and Manitoba was reported at 28,405 persons. Their total commerce in 1865 was £228,591; in 1866, £202,448; in 1867, £111,796; in 1868, £112,699; in 1869, £152,926. In 1870 the commerce was about £280,000, while the population is estimated at 45,000. It is easy to see that in such a sparse, undeveloped region the local traffic for years to come must be extremely small. Much reliance is placed on the large land grant, and the income therefrom will be considerable, though in so high a latitude the temptation to emigrants will be much less than in our own sunnier and more inviting lands. The through traffic, as experience shows, will yield very small net earnings towards paying the guaranteed five per cent. on the outlay. As the road will therefore be a dead weight on the Canadian Treasury of six and a half millions of dollars a year, at least, it is not difficult to see the ground of the vehement opposition the scheme is meeting from a few economists in the Canadian Legislature.

There are rumors, however, that the Imperial Treasury will in some way interpose, and the railroads of British India show that England is prepared to make great sacrifices to secure in any contingency a free development and an uncontrolled communication for her oriental customers and her Indian possessions. As a great military road, the British Pacific offers advantages which cannot be over estimated for the consolidation and unification of the colonies. At present our Central Pacific road offers the only swift route through an English-speaking country to the ports on the western coasts of this continent, while the Panama Railroad offers similar facilities to the ports of South America. The Asiatic ports of Russia, the newly opened ports of Japan and China, the Sandwich Islands, the Spice Islands, New Zealand and Australia, are all developing a new active trade with this country and with Europe. Still the through freight will cost heavily on this long English railroad, and will seek other less costly and established routes. Travel and express freight may, perhaps, be attracted from the better known routes to the new British road. But it is uncertain. There is every reason to believe that the ten years in which this road is to be finished will make New York the undisputed master of European, and San Francisco of Asiatic communication over this continent.

Moreover, England will find the Suez route to India, whether by railroad or canal, both cheaper and quicker than her proposed Interoceanic Railway. The Cape of Good Hope route will be cheaper, if not quicker. From England to China the time by way of Suez may be less, but the cost higher. To Japan and New Zealand the route over some part of this continent will be much the quicke t, as also to the Pacific ports, from Sitka in the north to Valparaiso in the south. But before this road is opened, travel will have become so accustomed to move in our channels of transportation as to be loath to leave them. "Trade loves its old grooves," as we are told, and we should not have attracted to our new American routes so much of the through traffic with the Orient, but for the disturbance of the old routes of travel, by the gold discoveries, the Crimean war, the Indian mutiny, the troubles in Egypt, the Suez Canal, the Mont Cenis summit and tunnel railways, the wars and rumors of war in Continental Europe, and finally by the disturbance of the old Marseilles line of packet steamers and their transfer to Brindisi on the Adriatic, whence steamers can find a much shorter line of voyage to Alexandria than from Marseilles. So great a revolution has not had its analogy in the changes of the grand routes of commerce since the taking of Constantinople by the Turks and the discovery of the Cape of Good Hope by Vasco di Gama. Our Pacific Railroad was not constructed a year too soon, to enable it to attract over our territory the rich oriental commerce thus disturbed from its old channels. When the quietude has been re-established and trade has become established in its settled grooves, it will not be so responsive to new impulses or so susceptible of new directions.—*Commercial and Financial Chronicle.*

Effect of Cold on Iron and Steel.

A correspondent of *The Engineer* suggests that in the numerous experiments on the effect of cold on iron and steel, where the metal has been exposed but a few minutes to the severe cold of a freezing mixture, the structure of the iron is affected only close to the surface, whereas in cold countries, where the iron is exposed for days or weeks to a temperature below zero, the structure of the entire mass is changed. In regard to this *The Engineer* says:

"In nearly all the experiments of which we have any knowledge, that have been carried out in England, freezing mixtures have been used for a few hours, or the bars to be tested have been exposed to a night's frost. We do not go so far as our correspondent, and hold that only the outer skin of the iron is in such cases affected; but we do hold with him that, were the cold long continued its influence on the metal might be very different from that due to the action of frost for a few hours only. It is well known that the long-continued action of a moderately high temperature, as in the case of boiler plates, tends to render iron brittle, by inducing some obscure molecular action; is it not possible that long-continued cold may act with equal force on the atoms of which the metal is made up? There is sufficient ground, we think, for inquiring further into this matter. It cannot be denied that more rails and tires break in winter than in summer; but it is equally undeniable that many laboratory and shop experiments go to show that cold has no injurious effect on the metal of which tires and rails are made. Various attempts have been made to reconcile these conflicting facts, but up to this moment no one has attended to the influence of the time of action of the cold on the metal; yet it is quite possible that it may solve the whole difficulty. One point in favor of the theory may be advanced, which is that tires and rails seldom break until a frost has lasted some days, and the continuance of frost is always attended by a progressive increase in the number of accidents arising from this cause. That is to say, it may be safely predicated that more ties and axles will break in the second week of a hard frost than in the first. Probably a limit is very soon reached, however, beyond which the time of action of cold ceases to have any further effect in deteriorating iron or steel.

Whatever the nature of the change effected by the action of low temperatures on iron and steel may be, it seems to be pretty well proved that it depends for its amount very much on the chemical composition of the metal and its attending components. Iron cold-short at ordinary temperatures becomes still more cold-short as the temperature falls. Last year the Swedish Government appointed a commissioner to visit Russia in order to investigate the effects of winter temperatures on the rails and tires used in that country. The evidence he collected goes to prove the startling fact that iron containing phosphorus in appreciable quantity does not contain more than one-third the power of resistance to concussive strains in winter that it manifests in summer. It further appears that steel is not so susceptible to the influence of frost as iron, and that the tensile strength of neither metal, when submitted to a gradually increasing force, is much affected. The Swedish commissioner arrived at the conclusion that for northern climates it is essential that only ductile metal, whether iron or steel, should be used; and that it is especially necessary that the quantity of carbon present should not exceed a half per cent. Russian railway engineers express no doubts regarding the influence of cold on iron and steel, scarcely a day passing in winter without broken rails and tires; and it may be safely assumed, we think, that Russian engineers know quite as much on the subject as any other individuals, whether engineers or men of pure science.